THURSDAY, DECEMBER 3, 1914.

DANTE'S ASTRONOMY.

Dante and the Early Astronomers. By M. A. Orr (Mrs. John Evershed). Pp. xv + 507. (London: Gall and Inglis, n.d.) Price 15*s.* net.

DANTE'S cosmological ideas and his exposition of medieval astronomical knowledge have been discussed by several of the numerous commentators of his writings. It is, however, useful to have them collected in one place and discussed by a writer having a sound knowledge of modern astronomy. Mrs. Evershed has therefore done good and valuable work by producing the present volume. After a rapid sketch of the principal celestial phenomena visible to the naked eye without instruments, she gives a popular account of the progress of Greek astronomy. The "list of principal authorities" at the beginning of the book shows that this account is mainly founded on some of the principal modern books and monographs on this subject. There are very few ancient writers in the list, *e.g.* Hipparchus, Ptolemy, Seneca, and others are conspicuous by their absence. On the other hand, Cicero, "De Senectute" is included, though there is not a word about astronomy in this little book except an allusion to Gallus, who was fond of predicting eclipses.

On the whole, the account of Greek astronomy is correct, but it would have been a help to readers who may desire further information if references to the sources employed had been given in each chapter; for instance, on p. 299 (note) the authority is no doubt Smyth's "Cycle of Celestial Objects," vol. ii., p. 332, which should have been quoted. Want of knowledge of the original writers occasionally leads the author astray, as, for instance, when she gives a picture of the great equatorial at Peking, and seems to think that this was a copy of one of Ptolemy's instruments. There is no mention of equatorials in the Almagest, and it is not even certain that the Arabs constructed them, though it is probable enough, since the idea of the Peking instrument appears to be due to a Persian, Gemal-ed-din. On p. 122 it is said that Hipparchus gives a list of sixteen time-stars culminating at intervals of an hour exactly, and that his knowledge of spherical trigonometry enabled him to calculate the time of night to within one minute. But there were forty-four of these stars, and their use did not involve any calculation, as they only served to regulate the water-clocks.

Passing to the Middle Ages, the importance of astrology in those days is duly pointed out. But it is not correct to call the art of predicting the fate of an individual "judicial astronomy," as the author persists in doing. It was called "judicial astrology," not to distinguish it from the science of stellar motions, but to show that it was a special branch of the more exalted, philosophical astrology, which sprang from the loftiest views of Greek thinkers about the unity of the Kosmos and the inter-dependence of all parts thereof. The astronomical work done by the Arabs is briefly mentioned, and it is justly emphasised that Dante owed his knowledge of Alexandrian astronomy solely to the text-book of Alfraganus (Al Fargani), which he had thoroughly mastered, so that we have in the "Divine Comedy" and the "Convito" an excellent picture of the state of science at the beginning of the fourteenth century. It is only very rarely that Dante gives any astronomical information not to be found in Alfraganus, one of the principal cases being the statement that the length of the tropical year is 1/100th of a day less than $365\frac{1}{4}$ days. The author says it would be interesting to know where Dante found this value. We think there can be little doubt that he got it from the "Computus Maior" of Johannes Campanus, a Canon of Paris, in the thirteenth century, which is extremely likely to have been known to Dante's teacher, Brunetto Latini, who lived some years in France, though he does not mention the small amount of 1/100th day in his "Trésor," where he gives only round numbers.

After giving a classified list of the allusions to sun, moon, planets, and stars in the "Divine Comedy," the author discusses the time-indications given through references to the positions of the heavenly bodies in the course of the poet's journey. They show that Hell, a conical cavity reaching to the earth's centre, was entered in the evening and left twenty-four hours later, while the ascent to the other side of the earth took nearly as long. Purgatory is a conical mount on an island in the midst of the watery hemisphere at the antipodes of Jerusalem. The time spent on it brings us to the morning of the seventh day, and the ascent through the seven spheres of the planets, the sphere of the Fixed Stars, and that of the Primum Mobile to the Empyrean took eighteen hours. As regards the assumed date of the journey, it has generally been supposed that this was the spring of the year 1300, to which the historical allusions decidedly point. But in 1897 Sig. Angelitti, of the Naples Observatory, published a paper in which he showed that the positions of the moon, Venus, and Saturn given in the poem agree wonderfully well with their actual places at the end of March, 1301. The greatest difficulty to those who accept the year 1300 has

always been that Venus in March of that year was invisible, while she ought to be a morning star in Pisces, which she was twelve months later. But it was pointed out six years ago that Dante very likely took the position of Venus from a perpetual Almanac compiled by a Jew. In the Hebrew original all the cycles begin in 1301, while in the Latin translations they begin in 1300, except those of Venus and the sun, which begin with 1301. It is therefore quite possible that Dante took the places of Venus for 1301, believing them to be for 1300, and Angelitti's tempting theory must therefore be abandoned, to the regret of the author of the present work, in which we cordially join.

J. L. E. D.

FOUNDATIONS OF SYSTEMATIC BIOLOGY.

Abstammungslehre—Systematik—Paläontologie—Biogeographie. Unter Redaktion von R. Hertwig und R. v. Wettstein. Pp. ix+620. (Leipzig and Berlin: B. G. Teubner, 1914.) Price 12 marks.

"TO no nation, except the German," says General von Bernhardi, "has it been given to enjoy in its inner self that which is given to mankind as a whole. We often see in other nations a greater intensity of specialised ability, but never the same capacity for generalisation and absorption." That is the German way of expressing the German capacity for organisation and compilation, which, when it produces works such as that of which the present volume is a portion, performs a valuable service to the intellectual world. The whole work, "Die Kultur der Gegenwart," purports to be a systematic survey of modern culture on a historical basis, portraying the fundamental achievements of the diverse centres of civilisation in their relation to the whole as it exists now or promises to be developed hereafter. The division allotted to the organic natural sciences comprises four volumes, of which this is logically the last. Volume ii., the only other as yet issued, was reviewed by us in April, 1914 (vol. xciii., p. 107).

In view of the claim mentioned above, it is interesting to note that the contributors are not all German, for besides R. Hertwig, L. Plate, A. Brauer, A. Engler, and K. Heider, there are the Austrians, R. v. Wettstein and O. Abel, the Dutchman, W. J. Jongmans, and the Dane, J. E. V. Boas. It is, moreover, pleasing to observe that these authorities do not neglect the workers in other countries, but, by the lists of leading books which they furnish, prove that in this department, at all events, all nations take their share, and that the fellow-countrymen of Darwin have no reason to feel ashamed. The truth is that, though in art there must be nationality, science has become absolutely international: the observation made by a Dane to-day is checked by a Japanese to-morrow, and an American then carries it a step further.

It would not be possible, even in several pages, to give a critical summary of what is itself a summary, and an admirably critical one, of the whole world's work in that which, from a theoretical point of view, is the most important branch of biology. Few men could have written a more lucid, a more just, or a more thought-compelling account of the doctrine of descent than Prof. Richard Hertwig. "It is," he concludes, "the only possible theory . . . and the one that has given the weightiest impulse to this science. The crowd of exact investigations that has resulted from Darwin's writings may seem to have gone beyond or even away from him; but these last years show an unmistakable return to the views of the great British naturalist."

The articles on geographical distribution by Profs. Brauer and Engler, on palæontology by Profs. Abel and Jongmans, on the classification and phylogeny of plants by Prof. von Wettstein, and on the phylogenies of invertebrate and vertebrate animals by Profs. Heider and Boas, may be open to criticism in details, but afford on the whole admirable digests, made interesting by the fact that the distinguished authors have taken their own lines on disputed questions. It is, however, the chapter by Prof. L. Plate on the principles of taxonomy with special reference to the classification of animals that fills the most urgently felt want. The mere description of new species, as carried out by too many writers, is far from being good systematic work, or even scientific work at all. But the true systematist has perpetually to exercise his mind with the most complicated problems of his science, cannot venture to eschew metaphysics, and has even to rival the poet in his use of the imagination. All systematists who would understand their own task should read Dr. Plate's illuminating review of modern methods and ideas.

F. A. B.

SCIENCE, METAPHYSICS, AND EDUCATION.

(1) *The Anthropology of the Greeks.* By E. E. Sikes. Pp. xii+112. (London: David Nutt, 1914.) Price 5*s.* net.

(2) *The Mechanistic Principle and the Non-mechanical.* By Paul Carus. Pp. 125. (Chicago and London: The Open Court Publishing Company, 1913.) Price 4*s.* net.

(3) *Transformisme et Créationisme.* By Prof.

J. L. de Lanessan. Pp. 352. (Paris: Librairie Felix Alcan, 1914.) Price 6 francs.

(4) *A History of Education in Modern Times.* By Prof. F. P. Graves. Pp. xv+410. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 5*s.* net.

(5) *Methodik und Technik des naturgeschichtlichen Unterrichts.* By Prof. W. Schoenichen. Pp. xiv+611+30 plates. (Leipzig: Quelle and Meyer, 1914.) Price 12 marks.

(1) THERE is always an interest, and often no little instruction, to be derived from a study of the science and religion of ancient civilisations, especially when considered in their inter-relations. One of the newest of sciences, anthropology, appears to be rooted in the earliest strata of thought, as, for instance, among the natives of Central Australia. Greek speculation upon the origin and development of mankind was not limited to fairy-tales of the Golden Age type. From Herodotus onward their best minds had a very shrewd idea of the real process, such as we have come to see it. Lucretius repeated, with original observations of his own, the anthropological theories of Epicurus. But these are the culmination of Greek scientific thought in this direction. They were foreshadowed by Aeschylus and Herodotus, and developed later. It seems that the Greeks, who certainly had considerable opportunities, thanks to their trade, travel, and warfare, collected a considerable body of data relating to savage and barbarous peoples in the west, the east, and the south. There was, of course, another school, the Platonic; it was true then, as ever since, that a man is born either an Aristotelian or a Platonist. Then, too, as now, the Platonist built upon teleology. Mr. Sikes has done well to collect every statement in Greek literature that throws light on the scientific ideas of that "most quick-witted and curious of human races," concerning the origin and development of their own species. It should be read by all anthropologists, whether their Greek is "less" or more.

(2) But the Greek mind was more interested in the problems of cosmic and ultimate metaphysics, and the issues waged between Determinists and Creationists, or whatever the two fundamental types of mind be termed. These issues seem destined to be eternal. So Dr. Paul Carus, following up his interesting propaganda of many years, writes some notes upon representative quotations from exponents of both sides. "Mechanicalism" and teleology are first contrasted. The "contributions," as they may be called, to his volume include some very interesting expressions of opinion, especially Mark Twain's philosophy and La Mettrie's famous exposition of man "as a machine." It is curious that La Mettrie, when persecuted for his opinions, found refuge in Prussia and received a pension from Frederick the Great.

In another chapter Prof. W. B. Smith's eloquent article from the *Monist* works up to the conclusion that "it is a false antagonism between the causative and the teleological conceptions of the universe." Dr. Carus's text is that "nothing moves, nothing stirs nor happens that does not act in agreement with the laws of motion, and there is no harm in it that man's activity takes place in perfect agreement with mechanical laws. A man's a man for a' that!" As for the ancient and modern puzzle—dualism or monism—he says, using Ezekiel's metaphor, "There are not two things, the spirit and the wheels, but there is one reality." "Both spirit and machine are one, and the universal dominance of the laws of form determining the detailed uniformities of motion, commonly called mechanics, is by no means a depressing or melancholy thought. The laws of form are the very means in which spirit reveals itself."

(3) That versatile writer, Prof. de Lanessan, has written a critical history of the relations between these two modes of thought. He considers that evolutionary determinism (*transformisme*) and animistic supernaturalism (*créationisme*) are ultimately the only possible theories of the universe. He traces their elements back to the priestly caste of Mesopotamian culture, and carries his account up to Darwin. Considerable space is rightly given to de Buffon, the teacher of Lamarck. Except in the most recent times, the great majority of determinist thinkers have fallen back upon animism to explain the ultimate origin of the universe, or the presence in it of mind. Prof. de Lanessan promises a second volume, dealing with the developments subsequent to Darwin.

(4) If objective science be described as the obverse of human mentality, education is its reverse. From another point of view, as old as the Greeks, education and socialisation—"politics" in the Greek sense—are complementary. Prof. Graves has written the history of education before the Middle Ages, and from that period to the eighteenth century. He now completes his survey by a volume describing the progress of educational theory and practice, the latter in particular, from the eighteenth century (inclusive) up to the present day.

It is curious to reflect that the "classical" education, still the pabulum of English upper-class youth, was denounced more than a century ago by the French reformer, Rousseau. Equally

interesting is the fact that practically all subsequent educational reformers have been the intellectual heirs of the French iconoclast, such as Pestalozzi, Fellenberg, Froebel, Herbart, and Montessori. While giving prominence to the evolution of education in America, Prof. Graves does not neglect this or other countries, and his account of the German experiments at Neuhof, Königsberg, and Keilhan is detailed. He has an interesting chapter on the introduction in recent years of scientific subjects into curricula, and another on the application of psychological results to the methods of education. The book includes an excellent selected bibliography, very useful in view of the enormous literature of the subject.

(5) The series of scientific and mathematical handbooks edited by Dr. Norrenberg is an encyclopædia for teachers. The fifth volume, on methods of instruction in natural history, by Prof. Schoenichen, of Posen, contains more than six hundred pages, crammed with detailed advice and facts. The author attempts, with success, to cover the whole ground of zoology, botany, and biology generally as an educational subject, and from the teacher's point of view. From psychological pedagogy to gardens and vivaria, he omits nothing that can come into the ken of the schoolmaster. Courses are laid down for the various classes in the Gymnasium, the Real-gymnasium, and the Real and Oberrealschule. The suggestions about methods of drawing, and those on excursions and collecting are excellent. A notable feature is the description of models, their manufacture and use.

Fas est et ab hoste doceri; the book is a triumph of method. A. E. CRAWLEY.

OUR BOOKSHELF.

The Rubber Industry in Brazil and the Orient. By C. E. Akers. Pp. xv+320. (London: Methuen and Co., Ltd., 1914.) 6*s*. net.

MR. AKERS contrasts in this book the unscientific, and unbusinesslike, rubber-collecting industry of Brazil with the rubber-planting enterprises of the British and Dutch East Indies, which are conducted on more or less scientific lines and with the commercial skill and acumen which distinguishes the two peoples concerned with these East Indian Colonies.

Compared with their competitors in the East, the rubber producers in Brazil have one great advantage—their trees are mature and in their natural habitat. This advantage is believed to account for the general opinion that Brazilian Para rubber is better than the plantation article from the East Indies. Many competent judges maintain that this advantage is illusory, and that properly-prepared East Indian plantation rubber, from well-established trees of fair age, is just as good as "fine hard Para," and that the premium obtained by the latter in the markets is the result of conservative prejudice on the part of manufacturers. However that may be, the advantage, supposing it is real, is bound to disappear, in view of the increasing age of the plantations in Ceylon and Malaya, and the untiring efforts of the planters there to improve and unify their methods of preparation.

In all other respects, such as cost and efficiency of labour, good administration and government, business skill and foresight, and last, but not least, the realisation of the necessity for scientific and technical research, the advantages lie with the East Indian producers, and Mr. Akers makes it clear that unless there is a drastic change in the conditions of working in Brazil, the rubber industry there is bound to disappear in the face of the competition of the East Indian plantations.

Mr. Akers probably records little that is new to rubber planters, but his book is none the less interesting on that account, and it can be cordially recommended to all who are interested in the development of this great industry, in which British enterprise and technical skill have played so large a part.

The Beginner's Garden Book: a Text-book for the Upper Grammar Grades. By A. French. Pp. viii+402. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1914.) Price 4*s*. 6*d*. net.

THERE is always much to learn from an American teacher of a rural subject. The science may be superficial, yet he manages to get his students to think about their work and to find reasons for the way in which the work is done. This book is a case in point. It takes the form of an address by a teacher of school gardening to boys engaged in the cultivation of school gardens. The American origin of the book little interferes with its use in this country. The English is almost free from Americanisms, and the cultivation of all our more commonly grown vegetables and flowers is described. The treatment of fruit culture and bastard trenching is inadequate, and grafting and budding are not even mentioned, but, on the other hand, several matters are dealt with that do not often find a place in gardening manuals. The chapters on the saving of seed and on gardening under glass are excellent. A good deal of gardening can be learnt by merely looking at the numerous illustrations.

An Introduction to Geology. By C. I. Gardiner. Pp. xiv+186. (London: G. Bell and Sons, Ltd., 1914.) Price 2*s*. 6*d*.

MR. GARDINER is well known as a field-observer, and has added largely, both by himself and with Prof. S. H. Reynolds, to our knowledge of Silurian areas. He now attracts others to his favourite studies by a clearly written introduction to geology, which will be of especial interest to dwellers in the English midlands. General principles are supported by more detail than is usual in elementary works, and this method carries convic-

tion as to the reality of the facts described. For instance, both a map and a photograph are given of Churchdown, the conspicuous outlier that rises above the Lias plain near Gloucester; while the description of the successive layers in the Victoria Cave furnishes an impressive picture of the history of British man. The statement of the loss of land along the Yorkshire coast demonstrates the effectiveness of forces now in action, and two successive views are given of the destruction of a chalk headland near Swanage.

The illustrations are practically all new, including a fine view into Lulworth Cove, taken from the hill at its west end. The printers have twice gone astray on the difficulties of Rhynchonella (pp. 60 and 79), and a bracket needs extension on p. xi to include the Cainozoic systems; but the mode of production shows how generously publishers are prepared to meet the demand for readable works on nature-study. G. A. J. C.

Catalogue of the Ungulate Mammals in the British Museum (*Natural History*). Vol. iii. Artiodactyla, Families Bovidæ, Subfamilies Ægycerotinæ to Tragelaphinæ (Pala, Siaga, Gazelles, Oryx Group, Bushbucks, Kudus, Elands, etc.), Antilocapridæ (Prongbuck), and Giraffidæ (Giraffes and Okapi). By R. Lydekker, assisted by G. Blaine. Pp. xv+283. (London: British Museum (Natural History), 1914.) Price 7*s.* 6*d.*

THE third volume of the British Museum catalogue of Ungulates completes the account of the antelopes (saiga, gazelles, oryx group, bushbucks, kudus, elands, etc.) and deals also with prongbucks and giraffes. Like its predecessors it is a fine piece of work with terse descriptions and scholarly synonymy. Its usefulness has been notably increased by the inclusion of fifty excellent figures, mostly of heads. As a work of reference it will be of great value and interest to those who have collected trophies of this sort. The prongbuck, the position of which has been the subject of discussion, is ranked by Mr. Lydekker as the only living representative of a separate family, Antilocapridæ. Another interesting type, the Okapi, represents a genus along with the giraffe in the family Giraffidæ. Among the many other interesting forms may be mentioned, Ammodorcas, Ægyceros (the Pala), the Saiga, and the Chiru.

LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*]

The Age of a Herring.

To my doubts as to the truth of Dr. Hjort's theories of the herring's age, Dr. Hjort and Mr. Einar Lea have now replied (NATURE, November 5) by recapitulating their main arguments. I can do little more than reiterate my own unaltered incredulity. My position is simply this, that a theory has been put forward which seems to me, *a priori*, extremely improbable, and that the statistical data on which it is based are, to my mind, not strong enough to support it. The large assertion that the Norwegian spring herring have consisted, in preponderating or overwhelming proportion, year by year from 1908 to 1913, of fish spawned in 1904, is based (so far as I can discover) on only nineteen samples, or little more than two a year, averaging somewhat above 300 herring each. Dr. Hjort and Mr. Lea have no difficulty in showing that their 1913 herring, grouped according to scale-rings or alleged years of growth, form a curve which is a bad fit to a probability curve; but they do not remind us that this so-called sample is no sample at all, but is a conglomeration of three separate samples from far-distant localities. Dr. Hjort's full data have not been published, so far as I know, for the years since 1909; let us try to discover how, for the year 1908, he arrives at the figure 34·8, which he gives (*cf.* NATURE, August 27, p. 672) as the percentage proportion, in the entire stock of Norwegian spring herring, of fish spawned (according to the evidence of their scale-rings) in 1904. I find that this determination was based on two samples only,[1] from different localities, one consisting of 881 fish, the other of 549. In the former sample the percentage of 1904 fish is given as 15·9, in the latter as 65·2. The former determination, by Mr. K. Dahl, seems a little shaky: for an independent determination of a part of the same sample, by Mr. Einar Lea,[2] gave the alternative value of 10·2. But be that as it may, I find that Dr. Hjort's result is obtained by the simple method of adding together the two samples, one of 881 fish showing 15·9 per cent., the other of 549 fish showing 65·2 per cent., and so the resulting mean value of 34·8 per cent., decimal and all, is straightway arrived at. It does not need the eye of a mathematician to see that, in a problem of biological statistics, such a method of calculation is inadequate; and that it neither proves nor even renders probable the conclusion drawn from it, namely, that four-ringed herring (whatever those four rings may mean) constituted 34·8 per cent. of all the spring herring in Norway, in the year in question.

D'ARCY W. THOMPSON.

The Cross X as a Symbol for Multiplication.

HISTORIANS of mathematics attribute the first use of the cross × as a symbol for multiplication to William Oughtred ("Clavis Mathematicae," London, 1631). See W. W. R. Ball's "Short Account of the History of Mathematics," fifth edition, 1912, p. 239; M. Cantor's "Geschichte der Mathematik," Bd. ii., 1892, p. 658; J. Tropfke's "Geschichte der Elementar Mathematik," Bd. i., 1902, p. 135. In some places, as, for instance, in Oughtred's "Circles of Proportion" (London, 1632, p. 38), the two bars of the cross are not quite straight, giving the symbol the appearance of the small letter *x*. In some of John Wallis's writings, as, for example, his "Elenchus geometriae Hobbianae," etc. (Oxford, 1655, p. 23), the symbol is not the usual cross, but is plainly the capital letter X turned on its side. In a paper by Lord Viscount Brouncker in the Philosophical Transactions (vol. ii., 1668, p. 646), the capital letter X occurs regularly as the symbol for multiplication. These and similar cases lead to the inference that the cross and the letter *x* were considered practically one and the same symbol for multiplication.

In this connection we desire to point out that the small letter *x*, and also the capital letter X, occur as symbols for multiplication before Oughtred (1631) in

[1] Hjort, "Rapports et Procès-Verbaux, vol. xx., p. 29. (Copenhagen, 1914.)

[2] "Public. de Circonstance," No. 53, p. 94. (1910.)

Edward Wright's translation of John Napier's "Mirifici logarithmorum canonis descriptio," brought out in its second edition at London in 1618, where we read p. (4): "The note of Addition is (+) of subtracting (−) of multiplying (x)." This is taken from a part of the book under the heading, "An Appendix to the Logarithmes," the authorship of which is not given, but is probably to be attributed to Samuel Wright, who is reported to have been the editor of the book. Accordingly, the symbol × occurring in Oughtred is probably a modification of the letter *x* that was first introduced at least thirteen years earlier, and probably by Samuel Wright. FLORIAN CAJORI.

Cambridge, November 25, 1914.

ANTARCTIC ADVENTURE.[1]

THIS full account of the life and work of Scott's northern party is a welcome addition to the longer story of their work by Commander Victor Campbell in "Scott's Last Expedition." It was originally intended by Captain Scott that this party, of six men all told, should make their base on King Edward Land. When ice conditions prevented this they searched in vain along the coast of Victoria Land for a suitable landing until they had no alternative but to make use of Cape Adare, Borchgrevink's old winter quarters. Commander Campbell was well aware of the drawbacks to this place, from which it is impossible to sledge overland in any direction, but he had no choice in the matter. Either the party must land there or return to New Zealand in the *Terra Nova*. The winter at Cape Adare was spent in comparative comfort and the account reads like that of any other antarctic winter under modern conditions of equipment. A well-equipped party, in good health, need suffer no particular inconvenience nowadays in a polar winter. Sledging in spring along the sea-ice to the north proved impracticable, and in this respect Commander Campbell and his men had the same experience that almost all explorers have had in the south. No travelling can be more precarious than that over sea-ice in the vicinity of open water.

But it is the story of the second year's adventures which is the most interesting part of this book, for it was then that the author and his companions went through an almost unique experience. The only comparable story in the annals of the south pole is the wintering of Gunnar Andersson and two companions of Nordenskjöld's Swedish Antarctic Expedition in 1903 in a stone hut at Hope Bay, Louis Philippe Land.

The *Terra Nova* had picked up the six men at Cape Adare early in January and landed them four days later at Evans' Coves, about 270 miles to the south. From there they were to be taken by the ship on her return to New Zealand in March. The *Terra Nova* failed in three attempts to reach them, and so they were left to their own resources. But we cannot understand why these six men were landed with only six weeks' sledging provisions, and skeleton rations for another four weeks. Nor does Mr. Priestley's account make this arrangement clearer to us. He admits, in fact, that Commanders Pennell and Campbell had agreed that if the shore party were not picked up by March 18 they were to resign themselves to spend another winter as best they might. At the time, no doubt, they both thought this eventuality a remote one: "we would all have sworn that if there was one place along the coast which would be accessible in February, this would be the one."

FIG. 1.—A glacier table. From "Antarctic Adventure."

But it was a risk that should never be taken in polar exploration if it can possibly be avoided.

The party spent the winter in a snow cave hollowed out of a drift, eking out their scanty rations with seal meat. They had a hungry winter, but appear to have been cheerful and in comparatively good health throughout. Commander Campbell and his comrades deserve congratulations for this achievement. In October they sledged southward along the coast to the main base of the expedition at Cape Evans. Doubtless this journey was impractical in winter, but we would have liked to read the reasons which decided Commander Campbell to winter under these difficult, not to say precarious, conditions, at Evans' Coves rather than attempt the retreat to Cape Evans, some 250 miles, in late autumn. It is not on account of new discoveries and scientific work accomplished that this volume is important, for of new discoveries the northern party had few,

[1] "Antarctic Adventure. Scott's Northern Party." By R. E. Priestley. Pp. 382 + maps and illustrations. (London: T. Fisher Unwin, 1914.) Price 15s. net.

and very seldom does Mr. Priestley reveal the result of their scientific work during the first winter: during the second, of course, little could be accomplished. But the interest of the volume lies in its being a full account of how six men lived through an antarctic winter practically on what land and sea produce, and so proved that this can be done with comparative safety. That is the importance of Mr. Priestley's book, and as such, it should be studied carefully by every future explorer in polar regions. The author has been careful to record every expedient and makeshift he and his comrades found useful in their long struggle against adverse circumstances, and it is all these trifling details that give great value to the book. The work is well illustrated and contains three maps.

R. N. R. B.

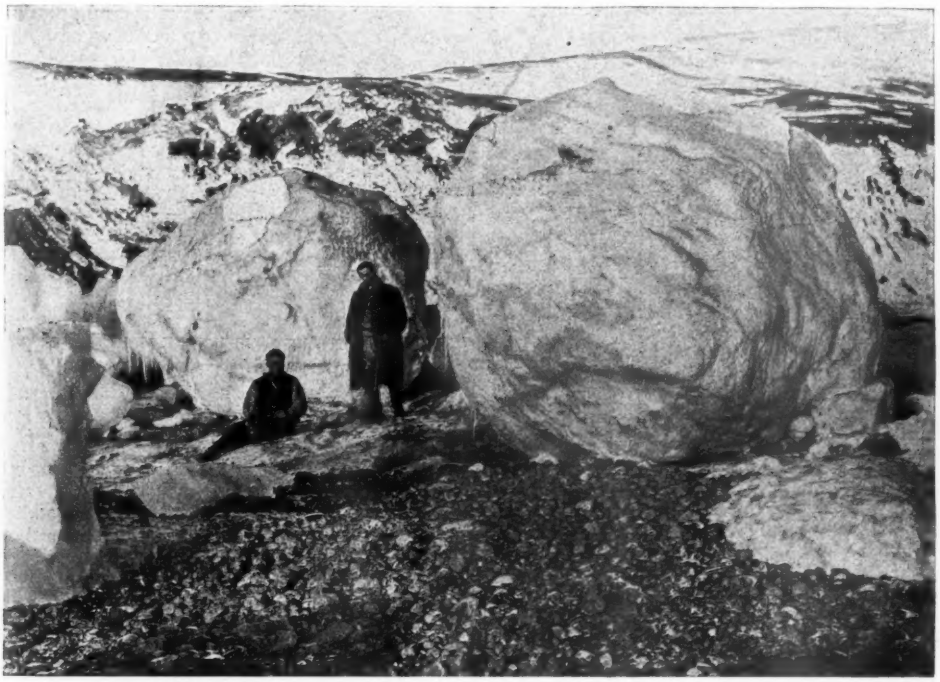

FIG. 2.—Ice boulders hurled up the beach by a heavy swell. From "Antarctic Adventure."

SECRET REMEDIES.

IT will scarcely be questioned that the freedom allowed to quackery in this country is unreasonable. To estimate properly the effect of drugs on the progress of disease in the human body is one of the most difficult of tasks, even for highly trained observers; yet any person vending alleged remedies is permitted to assert the efficacy of his nostrums in the cure of ailments, and to use the public as *corpus vile* for them, practically without let or hindrance. Not only so; he often mulcts the public heavily for the privilege.

This is the conclusion forced upon the reader by a perusal of the Report of the Select Committee appointed to inquire into the question of the sale of patent and proprietary medicines. The anomalies and curiosities of the law and practice concerning these commodities are, the Committee finds, "numerous and remarkable," but as they are not specially pertinent to these columns, the interested reader is referred to the Report itself for examples.

The medicines in question differ widely in character. "At one end of the scale is the valuable scientific preparation; at the other is the mere vulgar swindle." They are classified by the Committee as follows:—

Class A: Non-Secret.—(1) Proprietary preparations consisting of genuine drugs, synthesised or extracted by skilled chemists and tested by therapeutists. Examples are aspirin, adrenaline, and urotropine. (2) Remedies which owe their value to skilful combination, such as mixtures of bismuth salts with pepsine. (3) Known drugs, with the formula disclosed, but mixed for convenience with inert substances the nature of which is a trade secret—*e.g.*, "tabloids."

It is considered that, with some possible exceptions, there is nothing in this class which calls for interference in the public interest.

Class B: Secret.—(1) Simple household rem-

edies, often originally manufactured from a doctor's family prescription, and undoubtedly beneficial for uncomplicated ailments. The chief criticism made upon the sale of medicines belonging to this group is that their retail price is out of all proportion to their cost, and that they are often recommended for cases they cannot benefit, thus causing the purchaser to run risk of serious injury by delay in seeking proper medical treatment. (2) Dangerous remedies which should not be sold at all, or only on a doctor's prescription; or which should not be sold for the purpose for which they are offered. (3) Fraudulent remedies: these are a large group, consisting of abortifacients, alleged cures for cancer, consumption, diabetes, paralysis, epilepsy, deafness, and so on, together with electric belts, apparatus for supplying oxygen to the system (otherwise than by respiration), "ionised" water, and the like. With a touch of humour, the Committee remarks that "the discovery of radium will probably add a number of remedies to this group." It has, in fact, already added some. The treatment of "remedies" included in this category need involve no doubt or hesitation. "They are, and are known by their makers to be, cruel frauds." The sale and advertisement of them should be prohibited under drastic penalties. Finally, (4) there is a large group of remedies making grossly exaggerated claims. In respect of these, it is regarded as beyond doubt that the public is defrauded on a large scale by promises which cannot be fulfilled.

A good deal was said during the inquiry about the difficulty, and even the impossibility, of completely analysing certain medicines—a matter which is vital to many proposals for dealing with secret remedies by law. It was pointed out that even such familiar and apparently simple articles as extracts of dandelion and gentian are really highly complex bodies, the exact composition of which is still unknown to chemistry, and when several such extracts are present in a mixture detection of all becomes difficult, and accurate determination of any may be out of the question. But whilst this is true enough, the focussing of the discussion upon this point puts the matter out of perspective. There are limits to the powers of analysis, but in a large majority of cases the essential nature of the principal constituents of any medicine can be detected with almost perfect certainty and determined with reasonable accuracy, given skill, time, and a sufficient quantity of material.

Several abuses in connection with secret remedies are indicated. Thus the composition has sometimes been changed whilst the name remained unaltered; *e.g.*, acetanilide has been replaced by phenacetin, and the potent drug morphine has been added in one case, removed in another, without the change being brought to the purchaser's notice. Again, one medicine is recommended as "a safe and simple remedy" for both asthma and bronchial affections, though these are medically of quite different types, the former being a nervous disease, the latter an inflammation of the mucous membrane.

The Committee gives cogent reasons against adopting a suggestion made by medical witnesses and others, namely that every remedy sold should be compelled to bear a label stating its exact composition. This would inflict hardship; it would not necessarily convey useful information to the purchaser, who could not be expected to know chemical names such as, for example, "hexamethylene-tetramine"; moreover, an accurate statement might be in itself misleading. It is proposed, however, that an exact and complete statement of the ingredients and their proportions should be lodged with a department of the Government, and controlled by a confidential analysis. All patent, secret, and proprietary remedies should be registered with this department, and a special Court or Commission should have power to prohibit the sale or advertisement of such remedies, either in the public interest or on the ground of non-compliance with the law. New legislation is urgently needed to deal with a state of things which has become intolerable.

The findings and recommendations of the Committee are too lengthy to summarise further here. It may be said generally that the Report is fair but firm, and shows that its compilers, whilst considering legitimate interests, have not allowed themselves to be hoodwinked by the quack.

ORGANISATION OF SCIENCE.

JUST before the beginning of the war much fruitful discussion was going on in the columns of NATURE, the *Morning Post*, and *Science Progress* on the subject of the encouragement of science; and those who are interested in the theme should read Dr. R. S. Woodward's address on the needs of research, delivered on the occasion of the dedication of the Marine Biological Laboratory, Woods Hole, Massachusetts (*Science*, August 14, 1914).

Dr. Woodward begins by exposing some of the popular fallacies regarding research—that it "is akin to necromancy"; and that "the more remarkable results of research are produced not by the better balanced minds, but by aberrant types of mind popularly designated by that word of ghostly, if not ghastly, implications, namely, 'genius.'" He has also exposed the absurdity that research institutions should busy themselves in soliciting suggestions from the amateur public outside, that is, "in casting drag-nets in the wide world of thought, or in dredging, as biologists would say, with the expectation that out of the vast slimy miscellanies thus collected there will be found by the aid of a corps of patient examiners some precious sediments of truth." He thinks that "important advances in knowledge are far more likely to issue from the expert than from the inexpert in research."

Dr. Woodward traverses the idea "that research is a harmless and a fruitless diversion in the business of education"; and gives some figures

as to the comparative expenditure of the United States on education and research respectively.

The number of higher, or degree-giving, establishments in the United States is now upwards of six hundred; the aggregate annual income of these is upwards of one hundred millions of dollars; and the number of officials connected with them is upwards of thirty thousand. On the other hand, the number of independent research organisations in the United States is less than half a dozen; their aggregate annual income is less than two million dollars; and the number of officials primarily connected with them is less than five hundred.

Something very like this holds also in Britain, and indeed throughout the world. Men cannot be made to understand, even with the astonishing results which investigation has placed before us, the supreme importance of such effort. They still conceive that it is more important to teach boys how to do things than actually to get the things done.

The war now raging will at least demonstrate one thing to humanity—that in war, at least, the scientific attitude, the careful investigation of details, the preliminary preparation, and the well thought-out procedure bring success, where the absence of these leads only to disaster. So also in everything. After all, the necessity for research is the most evident of all propositions. But the question (which I hope will receive still more careful attention when the war is over) is, What can the State do to make the machinery of investigation the most efficient possible? The mere citing of popular misconceptions is not enough; we need to have specific programmes. The October number of *Science Progress* contains one such programme, which I hope will receive the attention of men of science. Whether all the items are accepted or not remains to be seen; but until the discussion is earnestly undertaken, we can scarcely hope that the State will give more help than it has done hitherto. Dr. Woodward puts his finger upon a weak point in men of science as a body. "We are," he says, "as a class of too recent monastic descent to fit comfortably in our present social environment." That is just it. We are not strong enough in making our demands heard; and, in my opinion, this is not a virtue, but a neglect of duty.

RONALD ROSS.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held on Monday, November 30, when an address was delivered by the president, Sir William Crookes, and the report of the council was presented. After referring to the financial strain under which the society and the National Physical Laboratory have been placed by the war, the president passed to the consideration of the constitution of the atom and the work of the medallists. Subjoined are the portions of the address referring to these matters:—

The subject of the constitution of the atom has come into extreme prominence—great advances have been made—while much light has been thrown on the ultimate structure of matter. Years ago, during the persistent and systematic fractionation of yttrium, I explained that I had succeeded in separating the atoms of the so-called element into groups; these groups undoubtedly exhibited different phosphorescent spectra and presumably had different atomic weights—although from the chemical point of view all the groups behaved similarly. I concluded that, of the lines and bands of the compound spectrum of an element, some are furnished by certain atoms and some by others. I pointed out that this was not likely to be an isolated case; that probably in all so-called elements the whole spectrum does not come from all the atoms—that different spectral rays come from different atoms, which may be interpreted to mean that there are definite differences in the internal motions of the several groups of which the atoms of a chemical element consist. I ventured to suggest a possible explanation of these facts, based on the assumption that acting on the original *protyle* were two forces—one of the character of Time, accompanied by a lowering of temperature, while the other, swinging to and fro like a pendulum, and having periodic cycles of ebb and flow, rest and activity, would be intimately connected with the force of electricity. I arrived at a presentation of the elements on a lemniscate path which seemed to me to throw some light on the question of their genesis. My researches seemed to show that the persistence of the ultimate character, the eternal self-existence, the fortuitous origin of the chemical elements, could no longer be regarded merely as probable.

Apparently bodies exist which possess close upon the same atomic weights and combine in definite proportions with other substances and yet exhibit certain minute differences. For these substances, which are capable of being isolated and identified, I suggested the name "meta-elements." Thus there appears to me to be a gradation of molecules of different ranks between the atom and the compound—and these aggregations of atoms in certain circumstances might well pass for simple elementary bodies.

In recent years the old idea of the ultimate atom as a solid particle, spherical or otherwise, has slowly, almost imperceptibly, given way to the more rational conception of a minute planetary or "Saturnian" system of dazzling complexity; the conception is many-minded, aided here and there by facts that failed to fall in with the old lines of thought. Among the most prominent men through which the new conception has come to light, we have Kelvin, Stoney, Thomson, and, more recently, headed by Sir Ernest Rutherford, a host of vigorous workers in the new science of radio-activity, who have built up a conception of atomic physics often "hard to be understood," but that probably is a move in the right direction. Sir Ernest Rutherford supposes the atom to be composed of a nuclear positive charge, exceedingly small compared with the sphere of action of the atom, and consisting of a number of unit charges. Surrounding this nucleus is an external shell in which a number of separate negative electrons are distributed. Prof. Soddy—whose name is closely associated with that of Sir Ernest Rutherford—is one of the earliest workers in radio-activity, and has developed a theory of the chemistry of the radio-elements based upon the periodic law and a modified form of lemniscate spiral where the existence of *pseudo*-elements having slightly different atomic weight but identical chemical properties are set out. These "isotopic" elements occupy the same place in the periodic table. He has

thus arrived, by a totally different path from the one I travelled, at the conception of an element having atoms of different weight though chemically identical. The theory has recently received some confirmation by the analyses of the lead that is found in the minerals pitchblende, thorianite, etc. In my own laboratory a spectroscopic examination of the lead from Cornwall pitchblende has shown traces of thallium not found in pure assay lead; the unexpected presence of this element may have some bearing on the slightly different atomic weight values recorded for the lead extracted from the radio-minerals.

Without risking a charge of being unduly optimistic I think I may believe we are on the brink of striking developments in our knowledge of the structure of the elusive atom. Whatever may be the outcome of researches now prosecuted with so much zeal and success, I feel that Addison was speaking with the voice of prophetic Truth when, more than a hundred years ago, he said: "Every atom is a standing miracle and endowed with such qualities as could not be impressed upon it by a Power and a Wisdom less than infinite."

Medals.

With great pleasure I announce that the Copley Medal this year is awarded to Sir Joseph John Thomson, in recognition of the value of his researches in physical science. His early work in the investigation of electrical phenomena showed he possessed a high degree of experimental ingenuity and skill: by his study of the passage of electricity through gases he elucidated the nature of the negative electrical particles, thus providing an experimental basis for the atomic theories of the nature of electricity. His treatise on the conduction of electricity through gases won for him a world-wide reputation as a physicist—to which subsequent work has added. To him is due the investigation of the nature of the positive carriers of the electric charge; his method of positive ray analysis puts a new and extraordinarily valuable tool into the hands of investigators. His experimental work has always been controlled and confirmed by theoretical considerations; his work at the Cavendish Laboratory at Cambridge has greatly extended our knowledge of the structure and nature of matter.

The two Royal Medals annually presented by the King have—with his Majesty's approval—been assigned to Prof. E. W. Brown and Prof. W. J. Sollas. Prof. E. W. Brown, who now occupies the chair of mathematics at Yale University, devoted himself for many years to the study of the movements of the moon; and by incredible industry seven years ago he brought to a successful conclusion his investigation of this fundamentally important practical problem. He has recently further studied some phenomena which known gravitation causes do not explain, and he has extended his investigations to the general theory of orbits. His work in dynamical astronomy has been remarkably fruitful, and doubtless the years to come will add lustre to his already brilliant reputation.

The Royal Medal—awarded to a worker in biological science—this year has been conferred on Prof. Sollas, who is a pioneer in many fields, and has made many valuable contributions to our knowledge of geology, mineralogy, zoology, and ethnography. His monograph on sponges is a classic on the subject. He has perfected a method of obtaining transverse sections of fossil organisms, and thus he has obtained a knowledge of the structure of certain specimens which long have been the subject of dispute. We hope that Prof. Sollas will have many opportunities of extending his investigations, which already have borne so much valuable fruit.

The recipient of the Davy Medal is Prof. W. J. Pope, who has made highly important discoveries in stereochemistry, and whose work has thrown much light upon the relation between chemical constitution and crystalline structure. In collaboration with Profs. Perkin and Wallach, Prof. Pope has published the results of many experiments dealing with the isolation and investigation of optically active compounds of nitrogen, tin, selenium, and sulphur; he explains their activity by supposing that the radicles in the active compound are tetrahedrally arranged round a central atom as in carbon compounds. With Prof. Barlow he has more recently been engaged in the establishment of a theory dealing with the connection between crystalline structure and chemical constitution. He has succeeded in reproducing the crystalline form of most substances of known composition, basing his work upon the assumptions of his theory—the experimental and theoretical results show a remarkable concordance. He has further suggested a theory of "valency volume" which is leading to important developments in the investigation of atomic volumes.

The Rumford Medal is awarded to Lord Rayleigh, in token of the council's appreciation of the mathematical and physical work associated with his name. Lord Rayleigh has, perhaps, done more than any scientific man living to stimulate research; his work in the sciences of heat and radiation has paved the way for remarkable advances, both theoretical and experimental. The Copley Medal was given to Lord Rayleigh in 1899, but the council wish to offer him some further mark of their recognition of the great value of the research which he still continues to pursue with such conspicuous success.

The Hughes Medal is this year conferred upon Prof. J. S. Townsend, of the University of Oxford, for his work upon molecular conduction in gases, and upon the nature of the disruptive discharge. Prof. Townsend has made a brilliant investigation of the phenomena of conduction by the ionisation of gases by means of Röntgen and similar radiations. The study of the diffusion of the ions of gases led to very important conclusions about the size and nature of gaseous ions—and the theory of ionisation has been greatly extended by Prof. Townsend's work.

The Darwin Medal this year is awarded to Prof. Poulton, in recognition of the value of his researches upon the curious phenomena of mimicry and protective resemblance in insects. Prof. Poulton has brought together a vast number of facts which confirm Darwin's theory on the subject, and he has recently devised and organised a remarkable series of breeding experiments with species of insects in order further to test his conclusions.

The report of the council refers, among other matters, to the effect of the war upon several undertakings with which the society is concerned. It is estimated that in connection with the International Catalogue of Scientific Literature the reduction of subscriptions and sales will mean a loss of about 4000*l.* on the three volumes in hand; and this loss will, at any rate in the first instance, fall upon the Royal Society. About forty members of the staff of the National Physical Laboratory are now serving with the colours, and this, with other results of the war, has had an adverse effect on the ordinary work of the laboratory. Should the war continue, it will be necessary to bring the question of the financial position of the laboratory before the Treasury at an early date. The donations to the society recorded in the report of the council are: 5000*l.* from Sir James Caird, in aid of physical research, the amount not to be

funded, but expended as capital at the rate of about 500*l.* a year; 2000*l.* from Mr. John Dewrance, as a gift to the donation fund to secure the payment of interest amounting to 100*l.* a year, to be expended in accordance with the terms of the trust of that fund; 4000*l.* from the Misses Lawrence, the income to be devoted to research into the causes and cure of disease in man and animals, the gift being associated with the names of their father, Sir William Lawrence, F.R.S., and their brother, Sir Trevor Lawrence; 100*l.* from the late Sir Joseph Swan, in aid of the expenses of publication; 1650*l.* from the late Mr. W. Erasmus Darwin, without conditions.

On account of the war, the usual anniversary banquet was not held this year.

NOTES.

THE Academy of Natural Sciences of Philadelphia, at a special meeting held on November 24, presented the gold medal of the Hayden Memorial Geological Award to Prof. H. F. Osborn, in recognition of his brilliant palæontological studies. The presentation address was delivered by the president, the Hon. S. G. Dixon.

AT a meeting of the organising committee of the sixth International Congress of Photography, held at the rooms of the Royal Photographic Society, on Friday, November 27, it was unanimously decided to suspend the work of the committee until such time as the officers should consider it could be resumed successfully.

ON Tuesday, November 24, the Royal Geological Society of Cornwall, at its annual meeting at Penzance, presented Mr. Henry Dewey with the Bolitho gold medal for his work and papers on the survey of Devon and Cornwall. Mr. Dewey afterwards gave an account of his experiments which led him to attribute the formation of Spilosites and Adinoles to the presence of ferric or ferrous oxides in the slates into which the igneous rocks had intruded.

THE death is reported of Dr. C. S. Minot, the distinguished American anatomist, in his sixty-second year. He graduated at the Massachusetts Institute of Technology in 1872, and then spent several years in study in Europe. At Harvard University he held minor appointments from 1880 to 1888, when he became assistant professor of histology. In 1892 he became full professor, and in 1905 migrated to the James Stillman chair of comparative anatomy. Prof. Minot was a member of numerous American and foreign learned societies, and an honorary doctor of Yale, Toronto, St. Andrews, and Oxford. He was the author of "Human Embryology," "Bibliography of Vertebrate Embryology," "A Laboratory Text-book of Embryology," and "Age, Growth, and Death."

MR. JOHN BURROUGHS, of West Park, N.Y., the veteran writer and observer whose works on natural history and other subjects have made him famous among lovers of nature and good literature in the old world as well as the new, has sent to the New York *Tribune* a convincing letter in which he explains why he and other Americans have had their regard for Germany turned to aversion by the events of the present war. The spirit of Prussian militarism is unworthy of twentieth-century civilisation; and though the military machine which crushes the innocent and unoffending, and destroys things beautiful and precious, in the hope of accomplishing its purpose, may be efficient, it is neither admirable nor human. "War," concludes Mr. Burroughs, "as now waged by the Kaiser against Belgium and France, is but a high-sounding name for the collective murder and pillage and arson of a vast organised band of outlaws, and for my part I believe it is the last spectacle of the kind, and on such a scale, that the world will ever see."

IN the October number of the *Victorian Naturalist* Mr. F. Chapman describes the impression of the fruit of a Casuarina in the basalt of Victoria. Wood of an apparently existing species of the genus has been previously recorded from beneath 90 ft. of the basalt.

IN concluding his notes on a collecting trip in Borneo, in the November number of the *Zoologist*, Mr. J. C. Moulton records the discovery of a previously unknown mountain—Mount Merinjak—in the heart of the country on the border between Sarawak and Dutch Borneo. It is a flat-topped mountain of 2220 ft. elevation.

AT the Cage-Bird Show held at the Royal Horticultural Society last week, Mr. David Ezra, of 110 Mount Street, W., exhibited specimens of living hummingbirds. The birds are stated to have been in London for the last six months or so. At this time of year they are kept in steam-heated cages, each furnished with a miniature furnace. The interiors are decorated with moss and orchids, the flowers of the latter furnishing the tiny inmates with nectar. When natural nectar fails, the birds are supplied with an artificial compound of honey, sponge-cake crumbs, and babies' patent food.

THE first part of an article on Japanese Lepidoptera and their larvæ, by Mr. A. E. Wileman, published in the June issue of the *Philippine Journal of Science*, is illustrated by three coloured plates of the caterpillars and pupæ of butterflies. A grass-green swallow-tail caterpillar marked with transverse golden bands harmonises in a striking manner with the trifoliate leaves of its food-plant, which have a yellow venation. Other articles in the same issue include one on Philippine medusas and a second on Philippine alcyonarians, both by Mr. S. F. Light. Two new generic types are named and described in the former and one in the latter; one of the new medusas, *Acromitus maculosus*, appears to be a very beautiful species, with a bell of fully 90 mm. in diameter. Lemnaloides, indicative of affinity with Lemnalia, is the name of the new alcyonarian.

THE fourth number of vol. ii. of the Science Bulletin of the Museum of the Brooklyn Institute is devoted to a report of the scientific results of a collecting expedition to South Georgia in a whaling brig, under-

taken by Mr. R. C. Murphy during 1912 and 1913. The main objects of the trip were to obtain a collection of South Georgian birds, and skins, and skeletons of the sea-elephant. Unfortunately the latter part of the programme was not accomplished, although a considerable series of sea-elephant skulls was obtained. Despite the lack of definite arrangements for collecting invertebrates, a number of interesting specimens were secured, which, together with certain plants, form the subjects of notes by specialists embodied in the report. One of the new types is an eight-rayed starfish, described by Prof. Koehler, of Lyons, as *Anasterias octoradiata*. During the voyage to the south specimens of the male of the minute parasitic crustacean *Pandarus satyrus*—previously known only by females—were obtained on the fins of a shark.

THE October number of the *Emu* contains a translation of an article by Mr. L. Brasil (originally published in the *Bull. Soc. Linn. Normandie*), on the emeu of King Island. In the early part of last century, when Baudin's expedition landed there, that island abounded with emeus, which were, however, soon after killed off. Péron found emeus both on King Island and Kangaroo Island, and in the account of his voyage, published a plate showing one black-breasted and a second and larger whitish-breasted bird. The former, as represented by a female specimen in the Paris Museum, certainly came from Kangaroo Island, but it has been suggested by Mr. G. M. Mathews that the white-breasted bird came from King Island, and is either the extinct *Dromaeus minor*, or a second and distinct species, *D. spenceri*. This view is disputed by Mr. Brasil, who considers that both Péron's birds came from Kangaroo Island, and suggests that the whitish-breasted specimen represents the male, and the black-breasted (as attested by the Paris specimen) the female. Whether the Kangaroo Island *D. parvulus* is really distinct from the King Island *D. minor* is left an open question.

IN addition to a paper on the nomenclature of local birds and another on the probable mode of extermination of the moas, to which reference was made in the issue of NATURE of November 5, p. 265, under the title of "Ornithological Notes," the Transactions and Proceedings of the New Zealand Institute for 1913 contain communications in which several additions are made to the fauna of the Dominion and the surrounding sea. Among these is one by Mr. S. Berry, of California, on a collection of cephalopods from the Kermadoc Islands, in which two new species of Polypus (Octopus), and a new squid of the genus Abralia are named and described; two of the new forms are figured. Certain New Zealand fishes—two of which are described as new—form the subject of an illustrated note by Mr. E. R. Waite, the most generally interesting specimen being a ribband-fish (*Lophotes cepedianus*) taken in the Wellington district. Two plates illustrating a long paper by Mr. M. N. Watt on the eggs of New Zealand Lepidoptera are notable on account of the exceeding beauty of form and sculpture of some of the specimens figured. Botanists will be interested in a communication from Mr. T. F. Cheeseman on the rate of growth of the kauri pine (*Agathis australis*), and the age to which it attains. It has been asserted that one of these giant trees, with a diameter of 24 ft., is more than 4000 years old, and a second, of 22 ft. in diameter, not less than 3600. In the opinion of the author, based on the number of rings of growth and an estimate of the rate of growth at different ages, these figures should be reduced, respectively, to 1396 and 1280.

ATTENTION has been directed on several occasions in these columns to the excellent work accomplished by the Essex Field Club. Among its many activities is the assistance the members of the club render to the Essex Museum of Natural History at Stratford. The museum is under the control and management of the Higher Education Sub-committee of the Education Committee of the County Borough of West Ham, while the care and arrangement of the collections are undertaken by the council of the Field Club in pursuance of agreements with the West Ham Corporation. The club also interests itself in a second museum situated in Epping Forest, the whole of the arrangement and organisation of which has been carried out by the honorary curators, Messrs. W., B. G., and H. A. Cole, assisted by other members of the club. At the Stratford Museum is a library of some 3000 volumes on natural history and kindred sciences, and local teachers are encouraged to make free use of them. Facilities for class teaching at the museum have been arranged, and teachers may also borrow duplicate specimens for demonstration. The excellent work in these directions which is being done by the Essex Field Club shows how much enthusiastic local societies can assist in scientific education.

IN two recent papers Dr. W. E. Agar continues his studies on heredity and the life-cycle in the Daphniidæ. The larger paper, on "Experiments on Inheritance in Parthenogenesis" (Phil. Trans. Roy. Soc., No. B 323), consists of a very interesting study of inheritance in parthenogenesis. As is well known, Johannsen and others maintain that within a "pure line" there is no inheritance of size-variation; all such variability is regarded as due to environment, and not inherited. These conclusions have been criticised by Prof. Karl Pearson, who adduced the work of Warren on Daphnia and an Aphid as being opposed to them. Agar has made very full experiments with the Daphnid, *Simocephalus exspinosus*, supported by less extensive work on other Daphnids and on the Aphid Macrosiphum. He bred many generations from single females hatched from ephippia, and although when the ancestral correlations are worked out in a population derived from a number of ex-ephippio females, these correlations are considerable (0·3–0·6), yet the parental correlation is in general no greater than the grandparental, or even great-great-grandparental. When, however, a population is produced from a single ex-ephippio female, there is no correlation at all between parents or earlier ancestors and offspring. The ancestral correlation in the first case is due to the presence of many genotypes among the population; within the single genotype the correlation vanishes. The paper contains

many other interesting points which cannot be alluded to in a short space. An earlier paper (in the *Journal of Genetics*, iii. (1914), p. 179) shows that in Simocephalus the idea of an inherent reproductive cycle is mistaken, and that the production of males probably depends on certain unknown factors acting in a cumulative manner over several generations.

THE December issue of the *Fortnightly Review* contains an article by Mr. J. B. C. Kershaw on the effect of warfare upon commerce and industry. He shows that the fluctuations of our trade during the past half-century have been largely independent of the wars that have been carried on by our own and other countries. The effect of wars upon the trade of this country will be measured to a large extent by the degree of their interference with the fundamental occupation of agriculture in the countries involved, and the results will be manifest, not at the moment, but in the year or years directly following the war.

WE have referred occasionally to the useful and somewhat laborious compilations of information relating to ice in the Southern Ocean contained in the monthly meteorological charts of the Indian Ocean issued by authority of the Meteorological Committee. The chart for December gives a table showing the number of instances, for each of the twelve months in the years 1885–1913, of reports that have reached the Meteorological Office. Out of a total of 1694 reports, 258 were for the year 1893 and 305 for the year 1906. The largest number of reports have been from ships traversing the South Atlantic, and mostly between Cape Horn and 40° S., and between 30° and 60° W., and the smallest number were from ships in the South Pacific; but it is pointed out that absence of ice in certain parts cannot be taken as proof that none existed. The highest of the bergs was 1700 ft. (June, 1884, 44° S., 49° E.); those of 1000 ft. are comparatively numerous. Bergs varying from five to twenty miles in length are frequently sighted south of 40° S.; and the tables show that icebergs extending from six to fifty miles in length are "far from uncommon" in the Southern Ocean.

IN the November issue of *Symons's Meteorological Magazine* "The Practical Utility of a World Bureau of Meteorology" is again urged by Mr. W. M. Hays and Mr. H. H. Clayton (see NATURE, October 1). The suggestions include: (1) the use of telegraphic weather reports from all available parts of the globe, for framing estimates of the effect of weather changes on crops, and (2) the unification and improvement of meteorological services generally. If such a scheme were really practicable as regards daily or seasonal weather forecasts, there could be little question of its general utility. The authors' own views upon the subject are supplemented by the opinions of eminent meteorological authorities, and in our issue of February 26 Dr. Shaw referred to the desirability of daily weather reports for the whole globe. To have any chance of success, such a plan as that now in question should (we presume) be recommended by the International Meteorological Committee as a body, but all efforts towards the creation of an independent institution at six international meetings, at least, led to no favourable result. The great enterprise of the U.S. Weather Bureau in establishing a daily service for the northern hemisphere may eventually aid the solution of the much more ambitious problem.

IN NATURE for October 15 we referred to the reported invention, by an Italian professor named Argentieri, of a "pocket" system of radio-telegraphy. We now learn from an Italian source that a gentleman of this name has been demonstrating a system of telegraphy before an Italian Government Committee, but what are the advantages claimed for the apparatus, and what its success, are at present being kept a secret by the parties concerned.

THE value of magnetic tests as a means of determining the changes which occur in paramagnetic materials at high temperatures is well illustrated by a paper by Prof. Honda and Mr. T. Soné on the changes of structure of certain iron and chromium compounds, which appears in the August number of the Science Reports of the University of Sendai, Japan. From their observations it appears that although at very high temperatures magnetite, Fe_3O_4, is more stable than hæmatite, Fe_2O_3, at temperatures below 1300° C., the reverse is the case, and that magnetite, once it is heated above 1100° C., is almost entirely converted into hæmatite, and remains hæmatite on cooling again to ordinary temperatures. This deduction from the magnetic observations has been confirmed by weighings. Heating to 1300° C. appears to produce no structural change in chromic oxide, Cr_2O_3, but chromium trioxide, CrO_3, appears to undergo two non-reversible changes.

IN a paper read before the Royal Society in 1909 Mr. S. Kinoshita showed that an α particle projected through a photographic film is capable, throughout the whole of its range, of making any grain of silver chloride it strikes developable. Since then, in company with Mr. H. Ikeuti, he has been using this method of tracing the paths of the α particles, and some of his results are reproduced in the September number of the Proceedings of the Tokyo Mathematico-Physical Society. The α particles were obtained from the end of a needle which had been rubbed on a metal surface previously exposed to radium emanation. The end was brought close up to or into contact with the photographic plate. After development the plate shows under the microscope a series of developed grains lying in straight lines radiating from, and forming a halo round the region of contact, extending 0·054 millimetre beyond the outside rim of the contact patch. These grains are distributed through the thickness of the photographic film, and are due apparently to the α particles from radium-C. Another series of developed grains close to the surface of the film appears to be due to α particles projected tangentially to the surface from active material slightly above it. A few grains still further afield the authors ascribe to β particles.

SUNSET "afterglows" resembling those seen after the memorable Krakatoa eruption were recorded on various occasions during the autumn and winter of 1913–14. We have now received from Prof. Ignazio Galli the third of a series of reports dealing briefly with these observations, this report being reprinted from the *Atti della pontifica Accademia romana dei nuovi Lincei*, vii., read last June. The phenomena were noticed for the first time at Rome on July 13, 1913, and about the same time at Bagnères de Bigorre, in the Pyrenees. The most noticeable display seems to have occurred on November 29, when it was recorded in France, Italy, Belgium, and England. At Rome the phenomenon was observed in a greater or less marked degree from February 15 onwards until April 10, but while in the typical afterglow the colour passes gradually from yellow through orange, sometimes mauve to a deep crimson, only the yellow and orange, sometimes only the yellow, were observed in the western horizon at Rome towards the end of this period. On the other hand, marked effects were recorded by Krebs in Holstein on December 31, when the moon added to the effect. The February glows were observed at Brussels, and particularly on February 19 in Morocco, where they were supposed at first to be due to an aurora borealis. In China, Father Corvillard describes fine displays on October 30, 1913, and April 18, 1914. Assuming these effects to be due to volcanic dust, as in the case of Krakatoa, Prof. Galli refers them to the eruptions of Katmai, in Alaska, on June 6, 1912, Asama-Yama in June 1913, Mount Benbow, in the New Hebrides, on December 6, and Sakarishima, in Japan, on January 11, 1914. These eruptions, especially the last, were accompanied by copious emission of dust, but whether the later date observations, particularly the Chinese one of April 18, were due to the last eruption, can scarcely be decided definitely on the evidence now submitted by Prof. Galli.

AN interesting paper on the presence of salicylic aldehyde in soils is contributed to the Journal of the Franklin Institute by Dr. Oswald Schreiner and Mr. J. J. Skinner. From certain soils, especially from some which had been used for intensive culture and greenhouse work, marked traces of an aldehyde could be extracted which showed the qualitative properties of salicylic aldehyde. The aldehyde extract was found to exercise a marked toxic effect on plant growth, and as the proportion of aldehyde is largest in the case of heavily manured greenhouse soils which have become "sick," there seems to be a relationship between the "sickness" and the proportion of aldehyde present. On the other hand, only a relatively small number of the poor soils examined showed the presence of the aldehyde, owing perhaps to the presence of other toxic substances. The material extracted by the aldehyde method was in all cases extremely small, and frequently gave no aldehyde reaction, although exercising marked toxic effect. What the harmful constituent in such cases is cannot yet be stated. In many instances the extract was not only not harmful, but exercised a stimulating effect on plant growth.

To the *Popular Science Monthly* for November Mr. R. Hugins contributes an interesting article on civilisation as a selective factor, in which it is contended that, contrary to the view generally put forward by writers in recent years, more particularly by Weismann and Wallace, there has been a real improvement of civilised man by an "agency at once powerful, comprehensive, and continuous." This agency may be designated the "elimination of the anti-social." The effect of this influence in modifying individual and national character is traced in its many forms, such as the elimination of the criminal, voluntary withdrawal, including suicide, occupational and geographical withdrawal, and, possibly most active of all, military selection, which by eliminating in the past large numbers of the predatory and intractable members of society has had the curious result that there has been an actual improvement of the military value of civilised races taking place side by side with the development of the moral character of those races. The reason for this apparent paradox is to be found in the fact that the same moral qualities have been selected through the elimination of the anti-social as are essential in the best armies—virtues such as obedience, the habit of discipline, self-control, and steadfastness.

WE have received a copy of a pamphlet entitled, "English, French, and German Vocabulary for Water Supply in the Field," prepared by Mr. Philip Parker, of 25 Victoria Street, S.W., for members of the expeditionary force. The pamphlet contains, in addition to what is implied by its title, a number of sentences in the three languages well calculated to be of great use to the soldier inquiring from a foreigner with regard to water supply. The words in the vocabulary, although necessarily not numerous, appear to be well chosen; the author, however, is apparently not very well informed as to some of the foreign equivalents of chemical terms, and some of the chemical formulæ are wrong. The pamphlet concludes with some instructions for the disinfection of water by chloride of lime. These notes are somewhat laconic and appear to supplement or emphasise other instructions on the same subject. The suggestions for a rough and ready method of determining the quantity of chloride of lime required are decidedly ingenious, but we fear that not only the suggested dose, which apparently works out at about three parts of active chlorine per million parts of water after fifteen minutes' contact, but, more particularly, the time of contact (fifteen minutes) of the water with the disinfectant are considerably too low for safety. Probably two or three times the dose with ten to fifteen hours' contact would be none too much to render a polluted water reasonably safe, and surely in a matter of this kind it is better to err on the side of safety. Apart from this, the pamphlet fulfils a very useful purpose, and we congratulate the author on the service he has rendered to our troops by producing it.

OUR ASTRONOMICAL COLUMN.

COMET NEWS.—A postcard from the Central Bureau at Copenhagen gives the elements and ephemeris of comet 1914*e* (Campbell), or comet 1914*d* (Lunt). The comet is faint, being of about the eleventh magnitude, but the following ephemeris, taken from the above, may be useful for those observers equipped with large telescopes :—

	R.A. (true) h. m. s.	Dec. (true) ° ′	Mag.
Dec. 3 ...	22 0 8	... +11 18·9	
5 ...	1 35	... 11 38·2	... 10·9
7 ...	3 4	... 11 57·3	
9 ...	4 36	... 12 16·1	... 11·1
11 ...	6 10	... 12 34·7	
13 ...	7 45	... 12 53·1	... 11·2
15 ...	9 22	... 13 11·3	
17 ...	22 11 1	... +13 29·4	... 11·4

Delavan's comet (1913*f*), now to be observed before dawn, has the following positions continued from the same source as stated last week :—

	R.A. (true) h. m. s.	Dec. (true) ° ′	Mag.
Dec. 5 ...	15 58 38	... +0 49·4	... 5·3
7 ...	16 2 29	... −0 9·9	
9 ...	16 6 16	... −1 7·8	... 5·4
11 ...	16 9 59	... −2 4·3	

A CENTRAL BUREAU FOR TRANSMISSION OF ASTRONOMICAL NEWS.—In this column for October 15 attention was directed to the fact that in consequence of the war there was no central bureau for transmission of astronomical news. A circular has now come to hand to the effect that Prof. Elis Strömgren, of the Copenhagen Observatory, has taken over the management of the bureau. The circular, dated November 3, reads as follows :—"I have the honour herewith to inform you that according to an agreement made between Prof. Kobold, of Kiel, as the publisher of the *Astronomische Nachrichten*, and myself, the management of the 'Zentralstelle für Astronomische Telegramme' during the present war has been passed over to me. Consequently, I ask you to let communications for the Zentralstelle be addressed to me until further notice."

THE RECENT ECLIPSE EXPEDITION FROM MEUDON.—M. Deslandres records in the *Comptes rendus* for November 16 (vol. clix., No. 20), a brief account of the expedition sent by the Meudon Observatory to observe the late total solar eclipse at Strömsund, in Sweden, the observers being M. Bosler, of the Meudon Observatory, and M. Block, of the Lund Observatory. They were equipped with an equatorial of 8-in. aperture, carrying two spectrographs and a photographic camera with coloured screens; the spectrographs were so arranged to record the regions λ780 to 500 and λ500 to 360 separately. While the results given are considered only as preliminary, it is mentioned that the first spectrograph has recorded the existence of a new, intense, and sharp radiation superposed on the continuous spectrum of the corona. The wave-length is given as λ637·5. This red ray, which, as is stated, is not chromospheric or has not been recorded as such, is attributed to the corona. On the other hand, the ordinary coronal radiation, the green radiation at λ530, is stated to be absent from the plate. M. Deslandres is inclined to conclude that this new radiation is special to epochs of minimum of solar activity.

SPECTRA OF NOVÆ AT A VERY LATE STAGE.—In this column for June of last year (vol. xci., p. 382) a brief account was given of Prof. Barnard's observations in that year of the magnitudes of the new stars which had been discovered from time to time. These stars had passed outside the reach of spectroscopic observation, so little was known about their physical condition. The general observed routine of the sequence of spectra of nova indicated that they, in their last stages, presented a nebular spectrum, the most prominent line being that at λ5007. Hartmann, however, in 1907 directed attention to the case of Nova Persei (1901) the spectrum of which in its later stages no longer exhibited the chief nebular lines, but presented a spectrum identical with that of the Wolf-Rayet star B.D.+35° 4001. The question whether all novæ behave in a manner like Nova Persei becomes of great importance, because it may help to elucidate any explanation of the origin of novæ generally. In this connection the 60-in. reflector of the Mount Wilson Observatory, combined with a slit spectroscope carrying a 60° prism, and collimator and camera lenses of about 16 cm. focal length, has been put to a useful purpose by investigating the spectra of faint novæ. In the *Astronomical Journal* for October (vol xl., No. 3, p. 294) Messrs. W. S. Adams and F. G. Pease describe the results of their photographic research, which they carried out at the end of last and the beginning of this year, in connection with four faint novæ. The following table gives the names of the new stars in question, their magnitude, the durations of exposure, and the date :—

	Magnitude	Duration of exposure Hours	Date
Nova Aurigæ of 1891 ...	14	16	1914 March 18–22
Nova Persei of 1901 ...	12·4	8	1913 November 27
Nova Lacertæ of 1910..	12·5	11·5	1913 October 29–31
Nova Geminorum No. 2 of 1912	10	2	1914 February 22

The results of the investigation may be summed up as follows :—The authors find that the spectra of Nova Aurigæ and Nova Persei are essentially identical with the spectra of some of the Wolf-Rayet stars, as Hartmann noted in the case of Nova Persei. Nova Lacertæ and Nova Geminorum are not yet old enough to have reached the stage when the chief nebular lines disappear, so that they cannot yet exhibit the permanent spectrum of spent novæ. It is suggested that the permanent spectrum of novæ, taken in connection with their agreement with some of the Wolf Rayet stars, and the well-known agreement of distribution relative to the Milky Way of both novæ and Wolf-Rayet stars, point to a close connection between some of the latter and temporary stars in the later stages of their history. The hypothesis that the phenomenon of a temporary star is due to a star entering a nebula is deserving of some attention, since the disappearance of the chief nebula lines is coincident with the emergence of the stars from the nebula.

THE ANTWERP "GAZETTE ASTRONOMIQUE."—It is proposed to recommence the publication of the *Gazette Astronomique* formerly issued by the Astronomical Society of Antwerp. The occupation of that town by the Germans occasioned the temporary suspension of the *Gazette*, and many of its supporters have now found hospitable homes in this country. A number of English astronomers, on the initiative of Mrs. Fiammetta Wilson, of Bexley Heath, are interesting themselves in the matter by financial assistance and the promise of literary contributions. It is intended to restart the *Gazette Astronomique* early in January in the French and English languages. The minimum subscription will be five shillings annually, but English astronomers who are able and willing to subscribe more liberally may send half-a-guinea or a guinea as a means of more effectively aiding their

unfortunate Allies in the attempt to revive their astronomical journal. It will be issued once a month unless circumstances should enable it to appear more frequently. Subscriptions and correspondence should be sent to Felix de Roy, Hon. Sec., 29 Stamford Street, London, S.E.

THE HARDENING OF METALS.

A VISITOR at the recent meeting of the Faraday Society could scarcely have failed to be struck by the fact that although the society was supposed to be discussing the hardening of metals, in reality the discussion centred almost entirely round the various theories of the hardening of steels. The reason for this was probably twofold. First, in spite of, or perhaps on account of, the considerable amount of research work that has been published on this problem it still remains the most keenly debated topic in metallurgical circles, and one on which widely different opinions have been held. Secondly, from a practical point of view it may be broadly stated that, in regard to hardening, steels are the only alloys that really matter.

Yet there can be no doubt that the council of the Faraday Society made a wise choice in the title of the topic for discussion. Even the simplest pure iron carbon steel is a complex material. Its complexity is due to the facts that (1) iron exists in at least two well-defined allotropic forms; (2) above 780° C. it is non-magnetic; below it, magnetic; and (3) carbon has a remarkable tendency to form compounds of a high degree of molecular complexity. While considerable attention has been directed to the first two aspects of the matter, the third has not yet received the attention that it deserves, and will require before a complete solution of the problem can be reached. The position, therefore, is that while steels may be the most interesting alloys to investigate it does not follow that they are most suitable. What is first of all required is a fundamental investigation of the theory of the hardening of metals from which the foregoing disturbing causes are absent. When the foundations of this have been securely laid the precise effect of the above "variables" will no doubt be elucidated by suitably chosen experiments.

This aspect of the matter was clearly seen many years ago by Dr. G. T. Beilby, who has investigated the physical mechanism of the hardening of metals such as gold, silver, and copper, which can be obtained in a high state of purity, and from which magnetic and chemical complications are absent. Until quite recently it would have been possible to say that allotropic complications were also absent, and so far as present knowledge goes they were absent in the case of gold and silver. Recent investigations by Prof. Ernst Cohen (Utrecht), however, have led him to conclude that the metals cadmium, lead, bismuth, copper, zinc, and antimony ordinarily occur as metastable systems consisting of two or more allotropic forms, so that this consideration must be kept in view. Prof. Cohen was unfortunately unable to be present at the meeting, but an important summary of his results was available and is worthy of very close study. Ordinarily the transformations from one allotropic form to another are subject to strongly marked retardations, and it is only by employing certain devices such as the addition of an electrolyte and the use of the metal in a finely divided state that the transformation velocity can be increased to such an extent that the change from the metastable to the stable form occurs within a short time. These transformations are frequently accompanied by marked volume changes leading to complete disintegration of the metal.

These recent developments do not, however, alter the fact that Dr. Beilby chose for his investigations metals of the most suitable kind from the point of view of arriving at a physical conception of the mechanism of hardening by mechanical deformation, and they enabled him to prove the existence of a thermally stable crystalline and a mechanically stable amorphous vitreous phase in each metal investigated. How far-reaching and fundamental these conclusions have proved to be is evidenced by the fact that all the papers dealing with the hardening of steels presented at the meeting incorporated and made more or less use of them. According to Mr. Humfrey, "The hard structure which can be produced in carbon steels by quenching and in certain alloy steels by normal cooling is due to the presence of a hard, amorphous solution of α iron and iron carbide." Mr. McCance's view is that the hardening is due to "interstrained" α iron, and the suppression of the carbide change. The theory of Profs. Edwards and Carpenter is that the hardness is caused by the complete suppression of the carbide change, together with the presence of amorphous layers existing at the surfaces of slip upon which copious twinning occurs when carbon steels are quenched. On this view the *final* cause of hardening by quenching is exactly the same as that of hardening by cold working, viz., the internal deformation of the crystals.

When these theories are carefully examined it is significant to note how much they have in common. All of them agree that the carbide (Ar 1) change is suppressed, a fact of very fundamental importance. The differences centre round the precise condition of the iron, and arise chiefly from differences in conclusions drawn from the magnetic condition of the alloy. They will not be adjusted until it has been settled whether iron can be magnetic in other than the α condition. Mr. McCance apparently denies that the iron in hardened steels is amorphous. It is not yet clear precisely what he means by the term "interstrain," and how it differs, if at all, from the term "internal tension," suggested many years ago by Metcalf and Langley.

Most significant of all is the fact that none of the above theories make use of β iron. This means that the controversy has essentially changed. It is no longer between the allotropists who laid chief stress on the postulated existence of a hard, stable, crystalline β iron, which was held to be primarily responsible for the hardness of quenched steel, and the carbonists, who denied this altogether, and ascribed the hardness to the action of carbon without, however, being able to explain it. The complete solution of the problem now appears to be bound up with the acquisition of a more intimate knowledge of the molecular combinations between iron and carbon in hardened steels and their variations in the hardening range of temperature. Stimulus to investigations of this character will no doubt be given by the substantial prize offered by Sir Robert Hadfield, the president of the Faraday Society, for the best research dealing with the combinations between iron and carbon. He has rendered an important service in directing attention to this difficult but neglected side of the subject.

H. C. H. CARPENTER.

AIR, CLIMATE, AND TUBERCULOSIS.[1]

IN October, 1891, Thomas George Hodgkins, of Setauket, New York, made a donation to the Smithsonian Institution the income from a part of which was to be devoted to "the increase and diffusion of more exact knowledge in regard to the nature and

[1] Smithsonian Miscellaneous Collections. Vol. lxiii., No. 1. Hodgkins Fund. "Atmospheric Air in Relation to Tuberculosis." By Dr. G. Hinsdale. Pp. x+136. (Washington: Smithsonian Institution, 1914.)

properties of atmospheric air in connection with the welfare of man." From this fund a prize of 300*l.* was offered in 1908 for the best treatise on the relation of atmospheric air to tuberculosis. Numerous essays were submitted to the adjudicators, and Dr. Guy Hinsdale, of Hot Springs, Virginia, was one of the successful competitors. His essay, enlarged and more fully illustrated, has now been printed in vol. lxiii. of the Smithsonian Miscellaneous Collections, Publication No. 2254. It is necessary to recite these details; otherwise it would be difficult to understand the *raison d'être* of such a work as that now before us, which is that of an enthusiastic specialist. It has its faults —many of them—it also has the virtues of its kind. It is an expanded essay. It contains an enormous amount of information; facts and figures abound, and anyone studying questions of climate, the effect of elevation, the condition under which moisture is precipitated, the action of sunlight and the like, will here find ample data for consideration. One cannot but feel, however, that to it might be applied with propriety the Scotsman's description of a "haggis" as "fine confused feeding." This is to be regretted, as one is constantly coming across evidence that if the author could only leave his authorities severely alone now and again and let us have the result of his own cogitations, a far more stimulating and quite as informative a book would have been the result.

Starting out from the Adirondack Forest, whither Dr. A. L. Loomis, of New York, sent patients in order that they might have the benefit of the purest and most invigorating air obtainable, and where Dr. E. L. Trudeau, who himself had benefited from the treatment, founded a cottage sanatorium in 1884, Dr. Hinsdale, after indicating the success of Dr. Trudeau's experiment, takes his institution as an example. He maintains that the condition of the atmospheric air may be of great importance in the successful treatment of tuberculosis, and that such pure air is to be obtained in the midst of an evergreen forest of more than 10,000 square miles. It was "common knowledge" in the days of Pliny that forests, especially those which abound in pitch and balsam, are beneficial to consumptives, or to those who do not gather strength after long illness, and that they are of more value than the voyage to Egypt (C. Plinii, Hist. Nat., lib. xxiv., cap. 6). Such forests are to be found in the Hartz Mountains and the Black Forest of Germany, in the Ardennes, the large American and Canadian forests, and in our own New Forest areas. Here the air is pure and moderately moist—an important feature, though one to which too little attention is paid—and the rainfall averages not too high, in order that patients may get out of doors during a considerable part of the year.

It appears that there is a slight excess of ozone in the air of forests, and this, of course, may be a factor in the treatment of consumptive patients, though it is maintained by some that ozone which, even in great dilution, irritates the lungs, the throat, and the frontal sinuses cannot be of much value in the treatment of such cases. The author ventures no opinion on this point, but quotes Lorrain Smith to the effect that oxygen which at the tension of the atmosphere stimulates the lung cells to active absorption, at a higher tension acts as an irritant and sets up inflammatory processes.

Perhaps the most important points brought out by Dr. Hinsdale in connection with forests and afforestation are that the work of raising, transplanting, and caring for trees is specially adapted to the strength of convalescent consumptives and that various forms of woodcraft, such as basket-making and the manufacture of small rustic articles, may easily be carried on under healthful conditions in the forest.

The site of a model sanatorium for consumption may, with advantage, be above the snow-line for some part, if not for the whole, of the year. Here there is less organic matter in the atmosphere, and, as demonstrated by Boycott and Haldane, it is the organic matter in the air and not an excess of carbon dioxide that gives rise to the discomfort, headache, etc., suffered in badly ventilated rooms; moreover, the anaphylactic phenomena corresponding to those noted in "horse asthma" or "stable asthma," may be avoided by changing the air even when considerable quantities of carbon dioxide are allowed to persist. It is interesting to learn that the consumptive daughter of the discoverer of oxygen, Dr. Joseph Priestley, was condemned to pass a considerable time in a cow-house in order that the diminished oxygen and increased carbon dioxide "might lower the inflammatory action associated with the disease." Dr. Beddoes, who had charge of the patient, thought that this treatment would not be acceptable to all his patients, "as it seemed to me hopeless to propose residence in a cow-house, I advised that the patient should live during the winter in a room fitted up so as to ensure the command of a steady temperature. This advice was followed. Double doors and double windows were added to the bedroom, the fireplace was bricked up round the flue of a cast-iron stove for giving out pure air." Dr. Hinsdale's comment on this note is that the doctor persisted in his plan of treatment until the patient died. Dr. Hinsdale, from his own experience, makes a further point on which sufficient attention had not been concentrated. It is not the expired air of tuberculous patients that carries infection, but the sputum and the tiny drops of moisture coughed by the patient that carry the bacilli and communicate the disease to others, but, be it remembered, that many of the bacilli carried into the nose, mouth, and upper air passages soon lose their activity or are extruded.

In his chapter on the influence of sea air the author mentions that Aretaeus, about 250 B.C., recommended sea voyages to the patient strong enough to endure them, for the cure of consumption, and that about three hundred years later Celsus prescribed a voyage from Italy to Egypt, or, failing this, that the patient should pass a large portion of his time sailing on the Tiber. Such treatment has fallen out of vogue, probably because long distances are now covered in such short periods that changes in temperature and atmospheric conditions occur far too rapidly, and the patient is unable to accommodate himself to them sufficiently rapidly. Patients who are fond of the sea and who have the opportunity of travelling in a sailing ship in roomy, well-ventilated cabins, and under medical supervision, even now receive great benefit from this treatment which, however, should not be used indiscriminately.

It would be difficult to follow the author through his disquisitions on warmth, moisture, fog, and the like, but it may be accepted that he favours quiet, bracing atmospheres, through which the sun's actinic rays can pass but little obstructed. These, he thinks, are to be found on high ground, where also expansion of the thorax almost invariably occurs, though, following our own surgeons who send their cases of surgical tuberculosis to Margate, he recommends sea air for such cases. High grounds, he maintains, are natural gymnasia where patients living out in the open air can *graduate* their exercise and form and absorb their own tuberculin. Dr. Hinsdale insists that rest is essential to the well-being of the patient during the febrile phases of phthisis, and that a patient must never *over-exercise*, as he is greatly tempted to do in clear, bracing climates. Finally, he comes to the very common-sense conclusion that when all is said and done it is the man behind the climate who is able to

treat a tuberculous patient with greatest advantage, and that even he can do little without the hearty co-operation of his patient.

Many interesting questions are raised by Dr. Hinsdale; he gives numerous excellent and interesting illustrations of shelters, of institutions, of methods of treatment, of the results of heliotherapy and immobilisation in plaster; he delineates patients before treatment, patients during treatment, in plaster jackets and in sun baths, and patients after treatment, and altogether makes us feel that the publication is what it pretends to be, a collection of data that will interest those engaged in the treatment of tubercular patients. With all this it is a constant matter for regret that the author has not put a little more of himself into his work. For what it is, however, we are grateful, and it may be anticipated that it will be very widely consulted.

THE BRITISH ASSOCIATION IN TASMANIA.

THE Tasmanian contingent of the British Association left Melbourne by the s.s. *Loongana* on Saturday, September 5, at 10.30 p.m., and arrived at Launceston about 5 p.m. on the following day. The party numbered twenty-one. Owing to an unfortunate dislocation in the boat service it was impossible to carry out the Launceston portion of the original programme, although time was found to visit the Launceston Museum on Sunday evening, under the guidance of the curator, Mr. H. H. Scott, to whose zeal and energy this excellent little museum owes so much. On the following day there was just time for a brief visit to the beautiful Cataract Gorge before leaving by rail for Hobart. Tuesday, September 8, was occupied by receptions at the Hobart Town Hall, the museum, and the university, and a luncheon at Government House, and in the evening Dr. G. T. Mcody gave a lecture on some commercial aspects of education. Wednesday, September 9, was devoted to a motor excursion to Mount Wellington, the party being entertained at lunch at the Springs Hotel by the Hon. Henry Dobson, who has done so much to open up Mount Wellington as a tourist resort. Some of the party proceeded on foot from the Springs to the summit, while others devoted themselves to the collection of natural history specimens, including the remarkable "mountain shrimp," *Anaspides tasmaniae*, so characteristic of the mountain streams of the island.

On Thursday, September 10, the party divided for several excursions in the neighbourhood of Hobart, including a dredging trip to the D'Entrecasteaux Channel, which resulted in the collection of much interesting material. On the following day they left for Maria Island, on the east coast, proceeding by motor as far as Spring Bay, whence the crossing to the island was made by motor boat. Maria Island is celebrated as the scene of a former convict settlement, and afterwards of various industrial experiments of the "wild-cat" type, in which much capital appears to have been sunk. The limestone rocks, of Permo-Carboniferous age, are crowded with fossils, which may be collected in unlimited quantity both in the "Fossil Cliff" on the shore and in an extensive quarry excavated to supply the now defunct cement works. Perhaps the most conspicuous of the fossils in the cliff is the large bivalve Eurydesma, but numerous others occur in profusion. A dredging trip in the neighbourhood of the island, in about 20 to 25 fathoms of water, yielded an enormous profusion of sponges in great variety, including some very remarkable and novel Calcarea. On the island itself numerous land planarians were collected, and the botanists were delighted to find the curious Tmesipteris growing upon tree-ferns.

The party left Maria Island early on Sunday, September 13, and after crossing to Spring Bay visited the kitchen middens at Little Swan Port. These were found to consist almost entirely of immense quantities of oyster-shells, forming a deposit several feet in thickness, and extending over a good many acres. The curiously rough chipped "flints," so characteristic of the Tasmanian aborigines, were found here in abundance. After lunch at Spring Bay the party motored back to Hobart through very beautiful scenery. This concluded the main part of the programme, but the zoological visitors remained by special invitation to take part in a collecting expedition to the Great Lake. Before leaving Hobart on this trip Prof. Dendy gave an address to the Royal Society of Tasmania on progressive evolution, and Dr. W. M. Tattersall delivered a public lecture on the depths of the sea. A visit was also paid to Mrs. Roberts in Hobart, whose collection of living Tasmanian and other animals excited much interest, two "native devils" (Sarcophilus) with young ones being particularly admired.

The party for the Great Lake started from Hobart on the morning of September 16 in three motor cars, and reached their destination the same evening. It had been hoped that they would be able to obtain a good deal of marsupial and monotreme material for the committee appointed by the council of the British Association for that purpose, but these hopes were only very scantily fulfilled. No monotremes were seen, though tracks and burrows of Ornithorhynchus were found on the shore of the lake, and only a very few wallabies and rat kangaroos were obtained to represent the marsupials. The invertebrate fauna of the neighbourhood, however, yielded a large number of extremely interesting specimens. The shrimp-like Paranaspides was obtained in quantities by dredging in the lake, and under the stones along the shore were found Phreatoicus, numerous freshwater planarians (one of remarkably large size), etc.

The forest around the lake has unfortunately been ravaged by fire, but laborious turning over of the fallen timber yielded many most interesting cryptozoic animals, including the land nemertine (*Geonemertes australiensis*), which was fairly common, a number of species of land planarians, and several specimens of the rare Tasmanian Peripatus (*Ooperipatus insignis*). The visitors returned to Hobart on September 22, and some of them left Launceston for Melbourne by the s.s. *Rotomahana* on the following day.

In every respect the Tasmanian visit must be regarded as a very great success. The thanks of the visiting members are due to all who contributed so generously to this result, and especially to his Excellency the Governor of Tasmania (Sir W. Ellison-Macartney) and Lady Ellison-Macartney, to the Premier and other members of the Government, to local scientific men, such as Mr. R. M. Johnston, Mr. Rodway and Mr. May, and, above all, to Prof. T. Thomson Flynn, the able and energetic organiser of the visit. A. D.

AUSTRALIA AND THE BRITISH ASSOCIATION.[1]

IT is just one hundred and forty-four years since the first scientific expedition from Great Britain to Australia visited Moreton Bay. The expedition consisted of his Majesty's barque *Endeavour*, a vessel which had been built for the coal trade and was chosen because she was an excellent sea-

[1] Concluding discourse delivered before the British Association at Brisbane on August 31 by Sir Edward Schäfer, F.R.S.

boat, and required a smaller complement of officers and men than a regular ship of war. It was commanded by Lieut. James Cook, and included Mr. Joseph Banks, a gentleman "possessed of considerable landed property in Lincolnshire, who although he had received the education of a scholar, had long desired to know more of nature than could be learned from books," and who afterwards, as Sir Joseph Banks, was for no fewer than forty-one years president of the Royal Society; Dr. Solander, a Swedish botanist and pupil of Linnæus, who was attached to the newly established British Museum, and who, along with two accomplished draughtsmen and a secretary accompanied the expedition at Mr. Banks's expense; Mr. Charles Green, one of the assistants of the Astronomer Royal at Greenwich; and other scientific observers. These gentlemen, in the words of one of the biographers of Captain Cook, "quitted all the gratifications of polished society and engaged in a very tedious, fatiguing, and hazardous navigation with the laudable views of acquiring knowledge in general, of promoting natural knowledge in particular, and of contributing something to the improvement and the happiness of the rude inhabitants of the earth."

I would not be so bold as to suggest that the present expedition has as high aims as those of its predecessor, nor would it be fair to press too closely the comparison between our present expedition and the certainly more famous expedition of Captain Cook, which first brought a ship-load of scientific men to this then inhospitable shore. But whether we may be lacking in quality or not as compared with the members of that expedition, at least we make up for it in quantity; and where the first expedition found nothing but rudeness and inhospitality on the part of the inhabitants, the members of our expedition have met with all the signs of an enlightened civilisation and have received the warmest and most hospitable of welcomes.

Could anyone authoritatively have foretold to Captain Cook and his companions what they were likely to find here if they were to revisit this spot, after a lapse of time which is after all measured only by the lifetime of two individuals, how great would have been their astonishment! That a fine city of nearly a hundred and fifty thousand inhabitants should be overlooking the magnificent bay which they christened "Moreton's," which is now traversed in every direction, independent of wind and tide, by huge, weird vessels, where its solitude was then only relieved by the presence of their own comparatively small sailing-ship; that some three hundred people, devoted to science, should have faced the dangers and other inconveniences of the deep in order to meet and compare notes with kindred spirits amongst the inhabitants of the opposite side of the world; and that large meetings should assemble for the discussion of scientific problems in magnificent halls, in places where the members of the first expedition found no habitations and none but the rudest of savages—these it must be admitted are facts which would be calculated to surprise the staid eighteenth-century men of science and mariners brought by the *Endeavour*, who were still in the habit of getting about quite satisfactorily to themselves with only such aids to locomotion as nature herself had provided, and who were not accustomed, as we are, to hear of a first-class scientific discovery every month or so.

Although I have spoken of the visit of Captain Cook's expedition to this spot, it is well-known that he did not actually land at Brisbane, nor did he even ascertain the existence of the Brisbane River, although we are told that it was inferred by some members of the expedition, from the appearance of the sea water, that a considerable stream must open into the bay. The wind was unfavourable for approaching the land more closely, or, as Cook tells us, he would certainly have made this the subject of a special investigation. But even although you—*i.e.* your predecessors in title—never had the chance of seeing the famous seaman in the flesh, that is no reason why his visit to your harbour should not be adequately commemorated, and I venture to suggest that the erection of a suitable memorial of so memorable an occasion as the visit to Moreton Bay in the month of May, 1770, of Captain Cook and his company will—when the present troubles are over—be an appropriate tribute to the deathless memory of the most famous navigator that our race has produced.

I have introduced the subject of Captain Cook's visit because it serves as a convenient illustration of the value to the world of the organised pursuit of any branch of science, however abstract and however removed from application to one's ordinary daily avocations it may at the time appear. For be it remembered that this expedition in the *Endeavour* was primarily intended for observing the transit of Venus at Otaheite, and was fitted out by George III.'s Government on the pressing representations of the Royal Society. Incidentally, and after the primary object had been carried out, the commander had instructions to make discoveries and surveys of the unknown parts of the South Seas; and the east coast of New Holland was visited after several months had been spent in cruising amongst the islands of the Pacific and circumnavigating and incidentally surveying the complicated coast line of New Zealand. Less than a month after leaving Moreton Bay the *Endeavour* struck a coral reef, and after being got off proved to be damaged to so serious an extent that but for a piece of rock having become broken off and embedded in one of the largest holes made in her bottom no amount of pumping could have kept her afloat. This incident of the embedded rock, and the fact that soon after she struck and whilst she was still on the rock a dead calm supervened might naturally have been regarded at the time as a special dispensation of Providence to preserve the expedition from destruction, but the historiographer of the voyage frankly admits that if Providence is to receive credit for stopping the leak it should have its share of blame for permitting the vessel to get on the rock at all.

"It will perhaps be said," says Mr. Hawkesworth, "that in particular instances evil necessarily results from that constitution of things which is best upon the whole, and that Providence occasionally interferes and supplies the defects of the constitution in these particulars; but this notion will appear not to be supported by those facts which are said to be providential; it will always be found that Providence interposes too late, and only moderates the mischief which it might have prevented. But who can suppose an extraordinary interposition of Providence to supply particular defects in the constitution of nature who sees those defects supplied but in part? It is true that when the *Endeavour* was upon the rock off the coast of New Holland the wind ceased and that otherwise she must have been beaten to pieces; but either the subsiding wind was a mere natural event or not; if it was a natural event Providence is out of the question, at least we can with no more propriety say that providentially the wind ceased, than that providentially the sun rose in the morning. If it was not a mere natural event, but produced by an extraordinary interposition, correcting the defect in the constitution of nature, tending to mischief, it would lie upon us to maintain the position; to show why an extraordinary interposition did not take place rather to prevent the

ship's striking, than to prevent her being beaten to pieces after she had struck."

But whatever part Providence may have taken in the transaction, it may be added, to give honour where honour is due, that she was materially assisted by the ingenuity of one of the midshipmen (Mr. Monkhouse), who carried out a method he had learned in the merchant service of introducing oakum and wool into the leak by rubbing a staysail with pieces of these materials loosely attached to it along the damaged bottom; so that a single pump was afterwards sufficient to keep the vessel afloat until a convenient place was found where she could be beached and repaired; although all hands that could be spared to work at three pumps were before scarcely able to keep the water down, and the men would soon have had to relinquish the attempt from sheer fatigue. One contemplates with dismay even at this distance of time the blank in geographical knowledge which would have persisted for many a long year if Captain Cook had met his fate off Cape Tribulation in 1770 instead of in Karakakoa Bay in Hawaii somewhat less than nine years later.

I am now going to ask you to make a jump with me of about sixty years and of half the circumference of the globe in order that we may be present at the birth of the British Association. This event, which was to prove of much greater importance than the founders of the Association could have conceived, occurred in the year 1831. A number of gentlemen, amongst whom are included the well-known names of Brewster, Lyell, Vernon Harcourt, Murchison, and Phillips, who were interested in science and believed in its value to the community, met in the month of September of that year in the ancient city of York. The object of the gathering was to try to spread a knowledge of the progress of science throughout the country by presenting new scientific facts, not only to other men of science, but also to the general public. These functions were already efficiently performed for London by the Royal Society and by the Royal Institution respectively, but nothing of the same nature had been hitherto provided for the provinces. With this laudable object it was decided to establish a peripatetic society which would visit provincial centres in Great Britain and Ireland in turn, and thus carry the torch of scientific enlightenment even to remote parts of the United Kingdom.

I think that if the founders of the British Association could have been told that in eighty odd years the Association would be carrying this torch to the Antipodes and would be holding a meeting of the Association at a place in New South Wales—of which Queensland was then a part—which had not even been marked on the map, their astonishment would have been nearly as great as that which I have supposed that Captain Cook and his companions would have experienced sixty years earlier could they have received similar information. That the holding of this meeting should be possible is due to the progress of the sciences which the Association was established to assist, and certainly very largely to the advances in what our American cousins call "transportation"—a term which had a somewhat more restricted meaning in the early days of this community. At the time of that memorable meeting in York—although it is true the Liverpool and Manchester Railway had been opened in the previous year—journeying by land still depended in its most advanced form upon the mail-coach, a vehicle which was regarded by our great-great-grandfathers as the *ne plus ultra* of speed and convenience, although we ourselves look back upon it as merely an interesting and picturesque phase in the evolutionary history of methods of locomotion. And it was not until seven years later that the first passenger steamer crossed the Atlantic, and the doom of the sailing ship was pronounced. Probably our own great-great-grandchildren will regard our present methods in much the same light as we do the old mail-coach and sailing ship, and wonder that we should have been so long satisfied with the servitude of land and water when the freedom of the air was to be had for the asking.

It must be admitted that this establishment of a scientific association for the provinces of the United Kingdom was a brave project at a time when four days or more were required by a coach to cover the two hundred miles intervening between London and York—a distance which now occupies an express train less than four hours, and which can be done by aeroplane in little more than half that time. York was, however, a relatively convenient centre, to which many lines of coaches converged from all parts of the country. Subsequent meetings held in Oxford, Cambridge, Edinburgh, Dublin, and Bristol must have presented greater difficulties, and for scientific men from remote parts to get across country to some of these places a month would scarcely have been too much to devote to the to-and-fro journey. Yet nowadays we think less of the voyage to and through Australia than our forefathers did of the journey from London to Edinburgh, so easy and comfortable is travelling rendered by the palatial steamers and luxurious trains which are at our disposal.

Those of us who are getting on in life remember when the Association first began to think of extending its sphere of operations beyond the confines of the United Kingdom. This was about thirty years ago, and the occasion was an invitation from Canada that we should include Montreal in our visiting list. The older and more conservative elements of the Association were up in arms at the suggestion. It was prophesied that such a change would break up the Association; that most of the regular *habitués* would not attend; that the meeting would have no scientific value, and would be little more than a sort of glorified picnic. It was also argued that if we go to Canada the Australians will be wanting us to visit their country, and this was regarded as indeed a *reductio ad absurdum*! But not only were these gloomy prognostications not fulfilled, but the dreaded sequel has come about without any manifest appearance of absurdity, and we have been in Australia for nearly a month, honoured guests of the Commonwealth, more than delighted with our reception, and hoping that we may leave behind us some elements of permanent benefit, although we cannot but feel that we shall be taking away, not only in general knowledge and experience, but also in some matters which are exclusively scientific far more than most of us have been able to bring.

These visits to the Dominions, which at one time seemed so impossible and are now so easy, exhibit the Association from a point of view which could, as I have said, never have been taken by its founders, however clearly they may have figured out the scientific benefits to be derived from its annual reunions. They furnish the most direct evidence possible of the bond which unites us into that singular body, the Empire, a body of which we are each and all inordinately proud, although it only consists of a congeries of States which are knit together by what in times of peace has sometimes seemed a perilously slender tie. The religious and political views which are prevalent in the several constituents of this inchoate body may and do differ *toto coelo*, and one might almost expect these differences to act centrifugally and tend in the direction of disintegra-

tion. In the matter of commerce and manufactures, also, there have been in the past, and still here and there survive, doubts as to whether our interests are identical. But that our scientific interests are the same is a doctrine which is received everywhere without question, and this community of scientific interests serves to bind together the constituent parts of the British Empire none the less firmly because it also helps to link us severally and collectively to the rest of the civilised world. For scientific knowledge and the benefits which accrue from it are never confined within the limits of any barrier, either of race or nationality, but are free to all people and to all nations. This fact has been long recognised, and we find in the history of Captain Cook's voyages a remarkable illustration of the principle (of community of scientific interest), in the rescript sent during his third voyage of discovery in the year 1779 by the Secretary for the Marine Department of France, with whom England was then at war, directing all captains of armed vessels who may meet "that famous navigator, Captain Cook," to treat him as a commander of a neutral and allied Power. A similar order was issued to all captains and commanders of armed ships acting by commission from Congress by the Ambassador of the United States to the Court of France, directing them to treat Captain Cook with all civility and kindness, affording him as a common friend to mankind all the assistance in their power, and assuring them that by so doing they might depend on obtaining the approbation of Congress. Franklin was, it is true, mistaken in the confidence he expressed regarding the sentiments which were likely to actuate Congress, the members of which displayed less enlightenment than their distinguished representative—but this is a commodity with which members of Parliament and Congress are not always too well provided even at the present day.

About the time of that first scientific expedition which I have ventured to use as a convenient introduction to a Brisbane audience, Watt was engaged in carrying out those improvements in the construction of machines which ushered in the age of steam and steel, and were eventually destined to enable us, within the period of our academic holidays, to hold our annual gathering at this end of the globe. Chemistry was beginning to feel its feet. Priestley had prepared carbon dioxide, and Lavoisier soon afterwards isolated oxygen. Discoveries were in the air, although the progress of science was very perceptibly checked by the long wars and general social disturbances which followed the French Revolution. After these wars ensued a period of exhaustion, during which commerce was only very gradually recovering her position, and although science was progressing, it was with relative slowness. Nevertheless, in Great Britain the important investigations of Humphry Davy into the chemical constitution of the alkalies, resulting in the discovery of several new metals, form a marked exception to this general statement; and Davy's successor, Faraday, was, in the twenties of the nineteenth century, commencing those brilliant researches which, with the previous work of Oersted and Ampère, form the basis of our knowledge of electricity and magnetism. The first publication of Faraday's discoveries of voltaic induction and the relation of electricity to magnetism took place in the year of the foundation of the Association, and the last of the more important of his papers on this subject appeared in the Philosophical Transactions of 1851.

Two or three years before the York meeting, the absolute barrier which was thought to exist between the organic and inorganic world was broken down by the discovery of Woehler that urea—until that time considered a purely animal product—could be prepared synthetically from inorganic materials. In biology matters had not moved so much. Nearly everybody still believed, in spite of the brilliant and suggestive theories of Lamarck and Laplace, that the round world and all that therein is was the result of a single act of creation which had occurred some four thousand odd years previously; and another thirty years were to elapse before that comfortable belief was shattered by the epoch-making observations and brilliant generalisation of Darwin and Wallace. The mere enumeration of everything that has grown out of the investigations and discoveries of the great men I have mentioned would much more than occupy the whole time allotted to this discourse. All the resources of modern civilisation, whether for peace or war, are indeed the direct result of the researches in physics and chemistry to which I have alluded, although many of these researches may have seemed at the time to be of purely scientific interest and to have no application to human needs. One can imagine a member of the audience at the Royal Institution asking Davy, "What can be the possible use of knowing that gases can be liquefied?" although no such question would be likely to be put to the present distinguished occupant of Davy's chair; or another member telling Faraday that his demonstration of the rotation of one coil of wire within another might make a pretty enough toy, but could never be of any practical utility.

Similar questions and remarks are still made whenever a discovery which is purely scientific is announced. Shades of Galileo and Galvani! Will the world never profit by the lessons which the history of science teaches it? Has it not again and again been shown that the establishment of a fact which at first sight seemed to furnish no possible utilitarian application has eventually far outweighed in its importance any number of discoveries which are capable of being immediately utilised in commerce or manufacture? You have, I suppose, all heard of the eminent man of science who thanked God that a discovery he had made could never, so far as he could see, be of the slightest use to any living creature! Probably he is apocryphal; but we see that there is some basis for his expression of gratitude, since it has again and again occurred that discoveries which appeared to be of no utility were pregnant with immense issues. Who could have thought it possible that Pasteur's investigation into the constitution of racemic salts would have led to a complete revolution in our knowledge of medicine and surgery, and in our methods of treatment, a revolution so complete as even to involve the use of a different kind of language to express the difference of conception of disease which characterises modern medicine as compared with that which was practised even so recently as the seventies of the last century? And although it is mainly to Lister that we owe the application of Pasteur's chemical and biological researches to surgery, we must not forget that their application to disease in general was due to the great French chemist.

It is not given to every man, as it was to Pasteur and Lister, to witness the full development of the discoveries which their experiments have initiated, or to receive during their lifetime the honour which is their due, and in most cases little or no benefit comes in the way of the actual discoverer. It is the man who applies the scientific discovery to the exigencies of manufacture or to commerce who reaps the harvest of the golden shekels. Not that we grudge it to him! But I

would none the less impress upon him and upon people in general the importance of encouraging and assisting in every possible way investigations in pure science, which of themselves bring no pecuniary reward to the investigator, but which may nevertheless prove of inestimable value to the community. The labourer is worthy of his hire—but the hire which the scientific labourer is considered worthy of is a mere pittance when compared with the colossal incomes which result from the application of his researches. It should be the aim of Governments to attract the best intellects to the pursuit of science, but few, if any, offer inducements to such to devote themselves to this study, a fact which fortunately does not always deter them from engaging in it. Virtue is, we know, her own reward, but the rewards offered by the pursuit of commerce, of law, and even of medicine are gilded with something much more tangible than the self-gratification which follows the pursuit of pure science. The first necessity of life is to be able to live, and unless a man can live, and not only live, but live comfortably and sure of freedom from pecuniary anxiety, he is not likely to produce the best work his intellect is capable of. I wonder when this will be understood. Be sure that the nation which first understands it will come to the front. Unfortunately, we find that things are in this respect no better, but rather worse, in democratic communities than in some of the supposedly effete monarchical systems of the Old World. Democracy must look to her laurels, or she will find herself left behind in the race for knowledge—and knowledge will always be power, as long as mankind continues to exist.

The remedy lies in the education of the people. It is certainly remarkable how little importance seems to be attached to scientific instruction as a part of general education. Science is, indeed, incidentally tacked on to education schemes, and a certain proportion of the coming generation are taught a little physics and chemistry, and sometimes a still smaller modicum of biology and geology; but our children, although trained in many subjects which are interesting in themselves, are, as a rule, not instructed in those which have a close relationship to the problems of their daily life. How few people know anything of the constitution and properties of things around them, things which are essential to their existence, such as air and water, and substances which serve them for food. How few know anything about themselves! If the proper study of mankind is man, how great is the neglect of that study! Surely it is more important that a man should understand how the world around him is constituted and how he himself lives and moves and has his being within it than that he should be efficient in ancient and modern languages, or in mathematics, or that his knowledge of history and geography should be as extensive and peculiar as Sam Weller's acquaintance with London! The appreciation of science by the people cannot come until the general ignorance regarding matters scientific is dispelled. And there is so much to learn, and so little time to learn it, that no child should be considered too young to be taught something about himself and his environment. Doubtless this would involve a change in the system of education which now everywhere prevails, but that it would be a change for the better and would conduce to the health and happiness of mankind cannot, I believe, be gainsaid.

We know what the past of science has produced: we have the evidence all around us. But what of the future? What is in store for our successors? Speculation regarding this is even more fascinating than the study of the past. Can we form any kind of anticipation regarding possible discoveries? In pure science I imagine not. Discoveries in this always come unexpectedly; at any rate, they are always unexpected so far as the world in general is concerned; which, indeed, only very slowly recognises them as real discoveries. Our speculations regarding the future must therefore be mainly confined to applications of what is already known, or to extensions along the lines which recent investigations have been laying down. But even so, the possibilities which are opening out to us are almost limitless. We are proud of the progress of what we Englishmen call the Victorian era, but is it not likely that this will be vastly eclipsed by the second Georgian? It took more than half a century to develop the steam engine, nor have we by any means as yet exhausted its possibilities. But the internal combustion engine has made more progress in less than half that time, and to it we already owe the supersession of animal traction on our roads, and the use of the air as the medium by which locomotion is or very soon will be effected. The applications of electricity which are already in use are dazzling in their variety, but we have scarcely touched the fringe of the applicability of the Hertzian waves, and the vast possibilities of radio-activity are still *terra incognita*. Who can reasonably doubt that we shall soon be flying safely through the air faster than the swiftest bird, and that our means of intellectual communication will be at least as much advanced as that of the transportation of our goods and bodies?

The rate of progress of chemical knowledge at the present time is no less extraordinary than that of physics. Every day shows an advance in our acquaintance with the structure of the molecules of which the elements and their compounds are built up. Our information regarding the complex molecules which compose living substance is receiving such continual additions and so much is already known about it that we cannot fail to recognise that the problems of life itself must sooner or later find their complete solution within the scope of physical chemistry. The attempts of science to solve the mysteries of the universe recognise no limitation: "thus far shalt thou go and no farther" is a command which can never be obeyed by the scientific inquirer. But to attempt to foretell coming scientific events even in the near future—merely to endeavour to guess at the kind of truths which are likely to be discovered—is a futile task. For the investigations of modern science are being extended to depths which have hitherto been regarded as unfathomable, and we can have no idea to what they will eventually lead us. Neither the infinitely great nor the infinitely small any longer presents serious difficulties to the investigator, by whom both the stars in their courses and the atoms which compose the molecules of matter—nay, even, the all-pervading and imponderable æther itself—are called to yield up their secrets.

We may be justly proud of what has been achieved, but let us not fail to remember with Newton that "the vast ocean of truth" still "lies" for the most part "undiscovered before us." However marked may be the progress of science, her individual votaries must always feel a sense of humility at the little the best of them is able to contribute towards the general result. Not that this thought need dishearten any scientific worker. For there is no other way of erecting an edifice, however stately, but by laboriously piling brick upon brick, stone upon stone, girder upon girder. And if our successors assemble here at the end of another century,

can it be doubted that the subjects which they will discuss will show as much advance in knowledge on those with which we have been dealing during this visit as the science of the present day transcends that of the beginning of the nineteenth century? I think that even if we had no other use for a future existence it would, at any rate, be interesting to our ghosts to be able to follow the progress of human knowledge and to observe how problems which during their life on earth were regarded as insoluble are ultimately solved by the *labor et ingenium* of those who come after us—an occupation which would I believe, be more congenial to most of them than those employments to which, by the general consensus of theologians, they are expected to devote their infinity of leisure. In the meantime, it is for us to lay our bricks well and truly, even although the opportunity is given to very few of us to witness a definite result of our labours. For we may be sure that every addition to scientific knowledge will help to promote the general happiness of mankind, and will tend to dissipate that ignorance which, in spite of the four intervening centuries, still remains as much "the curse of God" as ever it was in the days of Shakespeare.

Since this is the last general assemblage of the association which is to be held in Australia, it will, I trust, not be considered inappropriate for me to spend the few minutes which remain in endeavouring to formulate in the best manner I can—although the best will, I am conscious, be but imperfect—the impression which has been produced upon your visitors from the mother country by what they have seen and heard, read and learned of this antipodean country, its resources and inhabitants. To say that that impression is profound seems a commonplace, but there is no other word which can adequately express the actual fact. Your splendid organisations flooded us with information regarding the Commonwealth in general and the individual States which compose it in particular even before we started on our voyage here; and I suppose that we each and all of us have utilised some of the time which on a passenger ship is not occupied in eating and sleeping in taking in and digesting a part, at any rate, of the mass of statistics that the compilers of the volumes you have presented us with have provided. We have in our extensive journeyings had an opportunity of seeing some of the fine scenery which the country possesses. We have become familiar with your principal cities and with the magnificent streets and buildings which they contain. We have been exhaustively informed regarding the products of the country, both natural and artificial. We know, or can know if we like, the number of sheep, cattle, and horses which are annually reared; and although I have noticed that the number of rodents has nowhere been recorded in the literature with which we were provided, we may yet live to see the manufacture of coney sealskin develop into an important Australian industry. We are, or can be if we like, familiar with the output of gold and copper, of coal and opals; with the progress of the timber trade; with the development of the railway system, of telegraphs, of posts. We have made the acquaintance of your educational systems, and have had the opportunity of closely observing your universities and other institutions for advanced studies. We have seen something of the prosperity of your commerce and industries, and have been duly furnished with interesting and valued information regarding their growth and activity. We have even had dangled before our eyes statistics regarding the wages which you pay to your employees, until some of us have probably thought that it might be worth while to stay in the country and become Australian working-men, whose pay—with the possible exception of that of the San Francisco bricklayer—appears to be pitched on a higher scale than that of the same class anywhere else in the world, and in some cases to touch, if it does not even exceed, the salary of the average European professor. We shall indeed—some of us—go home knowing more about Australia than about our own country, and you may expect within a twelvemonth or so a perfect shower of books and magazine articles on Australia and the Australians; for does not every globe-trotter think he is capable of writing about the countries he has visited, even when he is not furnished with more information than is to be obtained in the average guide-book?

There is one phase of your development which cannot fail to interest not only the visitors to your shores, but the outside world in general, and that is the experiments you are making in dealing with such social problems as industrial disputes and the regulation of trade and manufacture. Many of these experiments are enough to make Adam Smith turn in his grave; but the proof of the puddin' is in the priein' o't, and if you are able to carry on your industries successfully to the contentment of employer and employed, and without the constant threat of strikes or lock-outs, you will find no lack of imitators on the other side of the globe.

A political experiment which, although not peculiar to this side of the world, may yet be said to occupy a more prominent position in it than in other parts where it has been adopted is the referendum. As you are probably aware, our politicians at home have always made a fetish of Parliament—by which they mean the House of Commons—and one of the assumptions which underlies the British constitution is that as long as a given Parliament exists—and it may exist with us for half a dozen years—it represents the settled opinion of the country, *i.e.* of a majority of the electors. But everybody knows that this opinion, so far from being settled, is often very unsettled, and in any case it need scarcely be said that questions may arise within the Parliamentary period which have never been before the electors at all. Whether for good or ill, we cannot but admit that the adoption of the referendum at home would soon settle certain vexed questions which have been, and still are, the source of a vast amount of political inquietude and even of grave social disturbance.

Although the nature and character of the inhabitants of a country is a question which is always treated prominently by travellers who are narrating their experiences, it is one which can scarcely be freely discussed in the presence of so large an assembly of the subjects of discussion. Nor has the difficulty been reduced by the extraordinary kindness with which we have been received by the inhabitants in every place at which we have stopped. But this, at any rate, can be said, viz., that—with the exception of a greater amount of warmth and spontaneity than we at home are accustomed to exhibit, combined with a certain tone of personal independence which, in the British Isles, is more common in the northern parts than elsewhere—there is no obvious difference in character between the man in the street here and the man in the street at home. Any change that has taken place is, at any rate, for the better, as is exemplified by the way in which your citizens of all classes have come forward, even in time of peace, to be trained for the defence of their country. If our responsible statesmen would imitate yours and give the lead on this vital question of citizen-service, instead of waiting to see which way the electoral cat is likely to jump, the people of Great Britain would not be long in following the example which the sense of patriotism of Australia has set them, and

they could then afford to smile at the idea of an invader setting foot within our little sea-girt land, sure in the prospect of its remaining the centre of "a greater Empire than has been."

And I think I may venture to assert that if we had adopted at home the principle of universal service for the defence of that Empire, a principle which that great man and soldier Lord Roberts has so persistently advocated, the present iniquitous war would never perhaps have been set on foot.

I suppose that, on the whole, one thing regarding the population of Australia that strikes the visitor from the Old Country more than another is the enormous disproportion between the extent of habitable country and the number of actual inhabitants. That a continent nearly as large as Europe should have far fewer inhabitants than London alone, and a density of only about one seventy-fifth that of Europe is an obvious incongruity. But it is one which will naturally tend to right itself as the years roll by; and since the necessity for a great increase of population in order to develop the country is forcing itself upon the attention of those who guide the fortunes of the several States, we shall no doubt witness, in the near future, a much more rapid rise of population than has occurred in the past. Fortunately, the increase which has taken place is of the right sort. Australia has, to its credit, long refused to be the dumping-ground for the dregs of the Old World, and is developing a race which will, in the course of a few decades, probably be more purely British, both in physique and character, than any other extensive area of population in the world, not even excepting the mother country. No nation has greater possibilities for the future. Assured of peace and of freedom from outside interference, there is nothing to impede that advance which, in her adopted motto, Australia puts before herself as her constant aim; and her invitation to us to visit her shores was, we may take it, not intended merely as an act of graceful hospitality, but also as a means of promoting within her borders that advancement of science which, as its title expresses, is the essential object of the existence of the British Association.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. T. V. Barker, fellow of Brasenose College, has been appointed University lecturer in chemical crystallography for five years from January 1, 1915; and Mr. A. G. Gibson, Christ Church, as University lecturer in morbid anatomy for five years from the same date.

SPEAKING at the annual meeting of the Sheffield University on Monday, the Vice-Chancellor, Mr. H. A. L. Fisher, said he believes that when the war is concluded it will be possible for England very largely to step into the place hitherto occupied by Germany. If our universities will only be a little more imaginative and try to reproduce some of the perfection of organisation which prevails in Germany, and has brought eternal honour to the German nation, our universities may become cosmopolitan in the sense in which Oxford was the great cosmopolitan university of the Middle Ages. It is only since the Reformation that English universities have become, in a sense, provincial. In certain regions of applied science there is no reason why in the next fifteen or twenty years Sheffield should not be the technical capital of Europe.

A COPY of the annual report of the 118th session, 1913–14, of the Royal Technical College, Glasgow, has been received. Judged by the tests now universally applied the session was one of the most successful in the history of the college. The number of day students continues to increase steadily; but the most satisfactory feature is the accession to the number of those attending full courses, resulting in a great expansion in "student-hours" of actual attendance and work. The total number of "student-hours" of the day classes was 237,908, an increase of more than 15 per cent. on the corresponding figure for the preceding session. The scheme affiliating the college to the University of Glasgow came into operation at the beginning of the session, with satisfactory results. Forty-one matriculated students were in attendance on qualifying classes within the college, and of these twenty-eight were following a full course of study. At present the scheme applies only to degrees in engineering, but the advisory joint-committee, established by the University and the college, has prepared a draft Ordinance for degrees in applied chemistry, which is now under consideration. It is hoped that this Ordinance will receive the approval of the Privy Council during the coming session, and thus give to college students in chemistry the opportunities for graduation now open to students in engineering. The report points out it is believed that more than a thousand past students have now joined H.M. Forces; the First Company of the 3rd Glasgow Battalion H.L.I. consists of college students exclusively. The Carnegie Trust for the Scottish Universities recently considered the position of the college in view of their allocation of grants for the next quinquennium. In the result, the trust made a grant to the college of 1000*l.* per annum for five years. Of this sum, 100*l.* is for the maintenance of the library, 300*l.* for provisional assistance, and 600*l.* towards a superannuation scheme. The college received during the year, among other gifts, legacies of 5000*l.* from the late Mr. William Weir, and 500*l.* from the late Mr. J. C. Alston.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 19.—Sir William Crookes, president, in the chair.—A. **Mallock**: Note on the circulation of the atmosphere.—Sir Sidney **Burrard**: The origin of the Indo-Gangetic Trough, commonly called the Himalayan Foredeep.—G. W. **Walker**: Approximately permanent electronic orbits and the origin of spectral series. In this paper an endeavour is made to find a basis of explanation of spectrum series in terms of strict electrodynamics. The illustrative system consists of a spherical nucleus radius a, with a positive electric charge E and a fixed magnetic moment μ. It is constrained to be fixed and may be regarded as corresponding to a comparatively massive atom. A single corpuscle with a negative charge e and mass m is free to move under the influence of the forces exerted on it by the nucleus. When the effect of radiation is neglected circular orbits are shown to be possible. The circumstances, stability, and range of these orbits are examined in detail, both for orbits outside and inside the nucleus. Only the inside orbits appear to have a bearing on the problem in hand. It is found that there is a class of circular orbits in each of which the angular momentum of the corpuscle has the same value. This result has already been obtained by Conway, who sought to identify the value with Planck's unit. It is here shown that these orbits occur only if the charge of the nucleus is concentrated mainly at the surface, or if the material of the nucleus has a large dielectric ratio. Another class of circular orbits exists. They lie in the equatorial plane of the nucleus, and have

different angular momenta. The formulæ, although possessing the same general features, are not so simple as those for the Conway orbits. The effect of radiation is next considered. The motion of the corpuscle gives rise to radiation disturbance inside and outside the nucleus, while the nucleus produces radiation in the manner proved by Lamb. The disturbance can be analysed into terms of electric and magnetic type. In each case a series of values of r/a are found for which the reaction on the corpuscle becomes very small, and so it is argued that the corpuscular orbit for which r/a has one of these values is comparatively stable and gives a spectral line. Following Lamb in supposing that the dielectric ratio is great, we find that from the Conway orbits with magnetic type of disturbance we get the recognised Balmer formula, while with the electric type of disturbance we get a series closely resembling the Rydberg formula. In addition to these series we ought to get Lamb's series from the nucleus, but quite consistently with the theory they may be in the infra-red or the ultra-violet. In order to fit the formula of Balmer type with the hydrogen series, and taking $e/m = 1{\cdot}7 \times 10^7$, $\mu = 1{\cdot}8 \times 10^{-21}$, the radius of the nucleus required is about 2×10^{-10} cm.—W. **Jevons**: Spectroscopic investigations in connection with the active modification of nitrogen. IV.—A band spectrum of boron nitride. (1) The interaction of active nitrogen and boron trichloride or methyl borate develops a band spectrum extending from λ 6371 to at least λ 2140, with well-defined heads degrading throughout towards the red. (2) The new spectrum consists mainly of two distinct systems, in the less refrangible of which each band consists of four heads forming two close doublets. The more refrangible system has single heads, and thus resembles the silicon nitride spectrum described in a previous paper. (3) The wave-lengths of the heads have been measured, and the wave-numbers in each system have been classified and represented by formulæ in the usual manner. (4) Chemical and spectroscopic evidence has established that the origin of the spectrum is boron nitride. Boron, carbon, and silicon compounds are thus alike in developing nitride spectra in the nitrogen afterglow. (5) The boron nitride bands, like those of cyanogen, are produced in the electric arc spectrum where they occur, together with bands of the oxide.—Prof. E. **Wilson**: An additional note on the production of high permeability in iron. It has been shown that if stalloy in laminated ring form is subjected to a magnetising force due to a direct current whilst it is cooling through the temperature at which it regains its magnetic properties, and is at the same time shielded from the influence of the earth's magnetism, the permeability recovered at atmospheric temperature has a maximum value of more than 10,000 when the magnetic induction was of the order 6000 C.G.S. units. It had been shown previously that high values of the permeability can be obtained without the use of a special magnetic shield when iron has impressed upon it a magnetising force, due to an alternating current, during the time that it cools through the temperature at which it regains its magnetic properties. As, however, in the last-mentioned case, an iron tube was used to enclose the specimen and became heated with the specimen, it was thought desirable to discover whether the high value of the permeability can be obtained when there is no question of magnetic shielding. In the present experiments the specimen of stalloy in ring form was allowed to cool inside a sealed fire-clay crucible, when subjected to a magnetising force of 13 C.G.S. units, and at atmospheric temperature a permeability of more than 10,000 was again obtained. Further experiments have been made with stalloy in the form of straight strips. The specimen which consisted of a number of strips side by side was wound with a magnetising coil and then placed inside an iron tube. On allowing it to cool through the temperature at which magnetic quality is regained, when subjected to a magnetising force due to a direct current, the improvement in maximum permeability, when at atmospheric temperature, was small, and had apparently disappeared when re-tested at the maker's works.

Royal Anthropological Institute, November 17.—Prof. A. Keith, president, in the chair.—The Hon. John **Abercromby**: The prehistoric pottery of the Canary Islands and its makers. In the museums of the Grand Canary, Teneriffe, and Palma a considerable number of prehistoric vessels are preserved. Anthropologists are agreed that the natives of the archipelago at the time of its conquest in the fifteenth century were a composite people made up of at least three stocks: a Cro-Magnon type, a Hamitic or Berber type, and a brachycephalic type. These natives were in a Neolithic stage of civilisation. Their arms were slings, clubs, and spears. Most of the people went naked, except for a girdle round the loins, and there was no intercommunication between the islands. Their stone implements were of obsidian or of basalt. Only four polished axes are known from the Grand Canary and one from Goméra. The axes are of chloromelanite, and of a type contemporary with megalithic structures in France. The first colonists probably brought the knowledge of making pottery with them, but each island developed an individuality of its own. Even the painted ware of the Grand Canary appears to be of local origin and not due to external influence. Although undoubted Lybian inscriptions in the Grand Canary and lava querns of Iron age type prove that the archipelago was visited before its conquest by the Spaniards without affecting the general civilisation of its inhabitants.—Major E. R. **Collins**: Stone implements discovered in South Africa during the Boer war. The paper dealt mainly with finds in or on the terrace-gravels, the principal sites being Burghersdorp, in Cape Colony, Spytfontein in the Orange Free State, and Vereeniging, Meyerton, Panfontein, Klerksdorp, and Vlekfontein, in the Transvaal. A few palæoliths from undisturbed South African gravels have been recorded, but several more were brought to light in digging shelter-trenches, and certain finds on the surface confirm the view that the early Cave-period of Europe is also represented in South Africa, quite apart from the supposed Bushman series.

Geological Society, November 18.—Dr. A. Smith Woodward, president, in the chair.—A. **Dunlop**: A raised beach on the southern coast of Jersey. The raised beach is on the eastern slope of the ridge between Le Hocq and Pontac. The section, facing northwards, shows the following succession of beds from above downwards:—

	Thickness in feet	inches
(1) Earthy loam, with a layer of rubble ...	4	0
(2) Stiff brownish-red clay	1	0
(3) Yellow loamy clay, containing water-worn pebbles and angular fragments	3	4
(4) Coarse brown sand	3	6
(5) Water-worn pebbles, closely packed in a matrix of coarse brown sand ...	4	6

The rock beneath is fine red granite. The section is terminated at its western end by sloping rock. The base of the section is about 50 ft. above mean sea-level. The pebbles are of the red granite of the locality, but some are of diabase and of quartzite, as well as a few of flint. Flint pebbles have also been found in two low-level raised beaches, and flint-pebbles and fragments have been noticed in the yellow clay. A raised beach was recently pointed out in the railway

cutting near the eastern railway station. Its base is about 55 ft. above mean sea-level, and it is covered by a thick bed of yellow loamy clay.—Prof. S. J. **Shand**: Tachylyte veins and assimilation phenomena in the granite of Parijs (Orange Free State). The district is the neighbourhood of Parijs township, situated on the Vaal River, and lies upon the northern portion of the Vredefort granite-mass. The so-called "granite" near Parijs is a red and grey streaky gneiss, often traversed by veins of red pegmatite; these are of a later period of consolidation than the rest of the rock. The grey facies of the gneiss results from assimilation of the country-rock by an ascending magma; while the red facies represents the residual portion of the same magma. The tachylytic veins everywhere intersect the granitic rocks. These veins range from a fraction of an inch to 2 ft. in thickness, but in the thicker veins there are numerous inclusions of the country-rock. They are irregular in form, thickness, and direction, and are due to the intrusion of a basic magma which underlay the district. The author brings forward evidence to prove that the position occupied by the tachylyte is independent of tectonic features, but follows directly from solution and corrosion of the granitic rocks by the basic magma.

Linnean Society, November 19.—Prof. E. B. Poulton, president, in the chair.—A. J. **Wilmott**: Discovery of *Hydrilla verticillata*, Casp., in Esthwaite Water. This is a small lake to the west of Windermere; and the discovery was made by Mr. Pearsall.—C. H. **Wright**: The Mosses and Hepaticæ of West Falkland Islands, from the collections of Mrs. Elinor Vallentin. Having made a collection of phanerogams and ferns, which formed the basis of a paper published in the Journal of this society, (Botany, vol. xxxix., 313–39), Mrs. Vallentin returned to the Falkland Islands and made collections of the lower Cryptogams. The present paper contains the determinations of this collection and attempts to bring together the information previously published on other collections. The genera represented are either terrestrial or aquatic, and the species much resemble those from the northern hemisphere. Many are capable of resisting cold and drought, such as they are exposed to in these wind-swept islands. Very little affinity is shown with the flora of New Zealand and the subarctic islands to the south of it.—R. S. **Bagnall**: Thysanoptera of the West Indies.

CAMBRIDGE.

Philosophical Society, November 9.—Prof. Newall, president, in the chair.—Sir J. J. **Thomson**: Experiments with slow kathode rays.—Prof. J. **Zeleny**: The conditions of instability of electrified drops, with applications to the electrical discharge from liquid surfaces. Experiments on the electrical discharge from liquid drops formed at the ends of small tubes, show that under some conditions the surface of the liquid is subject to more or less agitation. When the surface is examined under the instantaneous illumination of a spark, small masses of liquid are seen to be pulled away. This behaviour is shown to have no direct connection with the electrical discharge but is explained by the surface becoming unstable under the action of the electric forces, the observed electrical current being carried across the gas gap by minute electrified drops. The square of the potential at which the instability begins is directly proportional to the radius of the drop and to its surface tension, a relation which has been verified by experiment. Whether an electrical discharge, from a given surface, may begin before the surface becomes unstable depends upon the gas used and its pressure, since these quantities determine the starting potential for the electrical discharge.

MANCHESTER.

Literary and Philosophical Society, November 3.—Mr. F. Nicholson, president, in the chair.—W. C. **Jenkins**: Note on the aerolite which fell at Upholland, near Wigan, on October 13.—H. **Day**: Variation in a Carboniferous brachiopod. The species chosen for investigation was *Reticularia elliptica*, as a common and typical representative of the "*Spirifer glaber*" group, regarding which considerable doubt has existed as to the distinction of species and genera. This type is readily distinguished by its fine, reticulate ornament, but great variation is shown by individuals in respect of relative length, breadth, and thickness. The length, breadth, and thickness of each of 1000 specimens, collected from one spot, were accurately measured, and the ratios L/B and L/T were then determined. Each of these ratios was found to vary according to a symmetrical simple variation curve, leaving no doubt as to the specific unity of the assemblage. It was further ascertained that variation in respect of either ratio was nearly independent of that in respect of the other. There is, however, a slight tendency for breadth and thickness to vary together in relation to length, in such a way that both ratios on the average diminish as the individual increases in size.

November 17.—Mr. R. L. Taylor, secretary, in the chair.—F. W. **Atack**: The salt-formation of oximes. After outlining the current theory of oxime-isomerism, due to Hantzsch and Werner, the author pointed out that there is a notable discrepancy between the formulæ first deduced by Hantzsch and Werner in support of their theory and those in agreement with the Beckmann change, and this discrepancy has never been explained. Tschugaev's statement that only the so-called α-dioximes form characteristic salts with metals of the eighth group of the periodic system is incorrect, the author having obtained similar salts with the so-called γ-dioximes. It has been found that in case an "oxime" group forms a hydrochloride, it does not form such salts. New methods for the purification of oximes were outlined.

DUBLIN.

Royal Dublin Society, November 24.—Dr. J. H. Pollok, in the chair.—Prof. W. **Brown**: The fatigue of nickel and iron wires when subjected to the influence of alternating magnetic fields of frequency 50 per second. The results of some experiments showed that it takes about three times longer to fatigue an iron wire than a nickel one when tested under the same conditions.—Nigel G. **Ball**: The action of pectase. The action of the pectase of *Syringa vulgaris* on a solution of pectin was investigated by determining the change in viscosity of the mixture. In the presence of electrolytes the viscosity rose to a maximum and then decreased.—W. R. G. **Atkins** and G. O. **Sherrard**: The pigments of fruits in relation to some genetic experiments on *Capsicum annuum*. In Capsicum fruits red is dominant to yellow, chocolate, and orange. The reds and chocolates have oily pigments in plastids. These are distinguished from lycopin, carotin and xanythophyll by their ready solubility in cold alcohol and in petroleum ether.—W. R. G. **Atkins**: Oxidases and their inhibitors in plant tissues. Part iv. Peroxidase reactions of related species of Iris are similar, even though distribution of anthocyanin may be different. Alterations in peroxydase due to removal from light are not rapid enough to vitiate this conclusion. Anthocyanin is frequently present where there is no peroxydase. Well-marked inhibition patches are found in some species. Toluene water is as effective in removing inhibitor as is cyanide.

PARIS.

Academy of Sciences, November 16.—M. P. Appell in the chair.—H. **Deslandres**: Observation of the total eclipse of August 21, 1914, by the expedition from the Meudon Observatory. The expedition organised by the Observatory of Meudon made observations at Strömsund, in Sweden. Photographs were taken with two spectrographs, a brief description of which is given (see p. 373).—A. **Chauveau**: The question of the diminished resistance of enfeebled organisms to the destructive action of the tubercle bacillus. The author has previously published the view that healthy subjects, living in close contact with tuberculous patients, are as liable to contract tuberculosis as enfeebled subjects. They are all, strong and weak, equally liable to receive and cultivate the specific germs of the disease if these germs succeed in penetrating in the living state by the two usual modes of infection (respiratory or digestive). The author discusses from the public health point of view the opposite view more commonly held, and protests against erroneous interpretations of his views.—André **Blondel**: The most general enunciation of the laws of induction. Experiments are described showing that the enunciation of the laws of induction in some well-known text-books is too general.—M. **Courty**: Observation of the transit of Mercury made at the Observatory of Bordeaux, November 7, 1914.—P. **Gaubert**: Artificial macles of tin.—Marcel **Baudouin**: Discovery of a menhir remaining upright under a dune on the coasts of Vendée. The stone was found in modern Quaternary deposits and was indisputably of human workmanship.—Maurice **Lugeon**: The presence of crystalline plates in the Prealps and their signification.—H. **Colin**: The saccharogen in the beetroot.—P. **Hariot**: The marine flora of the island of Tatihou and of Saint-Vaast-la-Hougue.

CALCUTTA.

Asiatic Society of Bengal, November 4.—J. J. **Kieffer**: Chironomides du Lac de Tibériade. Six new species are described and one already known from Europe and North Africa (*Pelopia monilis*) recorded from the Lake of Tiberias.—H. **Sāstri**: Recent additions to our knowledge of the copper age antiquities of the Indian Empire. The note brings up to date the information about the copper or bronze antiquities of India by noticing some fresh material that has come to light since Mr. V. A. Smith wrote on the subject in the *Indian Antiquary*, and makes some corrections in the descriptions by Mr. Smith.

BOOKS RECEIVED.

Inaugural Address of the President, W. A. Evans, to the Members of the Leicester Literary and Philosophical Society, October 5: Wheat and its Relation to the Present Crisis. Pp. 20. (Leicester: W. Thornley and Son.)

Atti della Fondazione Scientifica Cagnola dalla sua Instituzione in Poi. Vol. xxiii. Anni 1908–12. (Milano: Tipo. Lit. Rebeschini de Turati E. C.)

The Museum of the Brooklyn Institute of Arts and Sciences. Science Bulletin. Vol. ii. No. 4: A Report on the South Georgia Expedition. Edited by R. C. Murphy. Pp. 43–101. (Brooklyn: The Museum of the Institute.)

Memorie del R. Istituto Lombardo di Scienze e Lettere. Vol. xxiii.–xiv. della Serie III. Fasc. I. Saggio di un Indice Lessicale Etrusco. By E. Lattes. Pp. 66. (Milano: U. Hoepli.)

The Trisection of Lines and Angles: Geometrical Researches in the Twentieth Century. By C. Guezouni. Pp. v+58. (London: International Scientific Association.) 1*s*. net.

The Royal Technical College, Glasgow. Annual Report on the 118th Session. Pp. 69. (Glasgow: Royal Technical College.)

Elementary Practical Chemistry. By J. E. Myers and J. B. Firth. Pp. viii+194. (London: C. Griffin and Co., Ltd.) 4*s*. net.

A First Book of Geology. By Dr. A. Wilmore. Pp. vi+141. (London: Macmillan and Co., Ltd.) 1*s*. 6*d*.

Insects Injurious to the Household and Annoying to Man. By Prof. G. W. Herrick. Pp. xvii+470. (London: Macmillan and Co., Ltd.) 7*s*. 6*d*. net.

Life of Sir John Lubbock, Lord Avebury. By H. G. Hutchinson. Two vols. Vol. i. Pp. xiv+338. Vol. ii. Pp. x+334. (London: Macmillan and Co., Ltd.) 30*s*. net.

Falske Analogier med henblik Lighed, Slægtskab, Arv, Tradition og Udvikling. By W. Johannsen. Pp. 114. (Kobenhavn: G. E. C. Gads Forlag.)

The Essex Field Club Year-book and Calendar for 1911–12. Edited by W. Cole. Pp. 32. (Stratford: Essex Museum of Natural History.) 1*s*. net.

Bartholomew's Orographical Map of Central Europe, showing Political Frontiers. (Edinburgh: J. Bartholomew and Co.) 2*s*. 6*d*. net.

Bartholomew's War Map of Europe and the Mediterranean. (Edinburgh: J. Bartholomew and Co.) 1*s*. net.

City and Guilds of London Institute. Department of Technology, Exhibition Road, London, S.W. Report on the Work of the Department for the Session 1913–14. Pp. 466. (London: J. Murray.)

Annalen der k.k. Universitäts-Sternwarte in Wien. Band xxiii., Nr. 1. Photographische Aufnahmen des Halleyschen Kometen und der Kometen des Jahres 1911. By Dr. J. Rheden. Pp. 28+Tafel 9. Band xxv., Nr. 1. Untersuchungen über das Rothschild-Coudé und den Coudespektrographen der k.k. Universitäts-Sternwarte in Wien. By A. Hnatek. Pp. 67. (Wien.)

On the Trail of the Opium Poppy. By Sir A. Hosie. 2 vols. Vol. i., pp. viii+300. Vol. ii., pp. 308. (London: G. Philip and Son, Ltd.) 25*s*. net.

University Correspondence College Calendar, 1914–1915. Pp. 217. (Cambridge: Burlington House.)

Meteorological Office. Geophysical Memoirs. No. 9: On the Relation between the Velocity of the Gradient Wind and that of the Observed Wind. By J. Fairgrieve. Pp. 189–207. No. 10. The Effect of the Labrador Current upon the Surface Temperature of the North Atlantic, and of the latter upon Air Temperature and Pressure over the British Isles. By Commander M. W. C. Hepworth. Part 2. Pp. 211–220. (London: Meteorological Office.) 1*s*. and 8*d*. respectively.

Ice Observation, Meteorology, and Oceanography in the North Atlantic Ocean. Report on the Work carried out by the s.s. *Scotia*, 1913. Pp. 141. (London: H.M.S.O.; Wyman and Sons, Ltd.) 4*s*. 6*d*.

Maps, Charts, and Diagrams to Illustrate the Above. Plates 35. (London: H.M.S.O.; Wyman and Sons, Ltd.) 2*s*. 6*d*.

The Modern Factory: Safety, Sanitation, and Welfare. By Dr. G. M. Price. Pp. xx+574. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 17*s*. net.

Constructive Text-Book of Practical Mathematics. By H. W. Marsh. Vol. iii. Technical Geometry. Pp. xiv+244. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s*. 6*d*. net.

Mathematical Monographs. No. 14. Algebraic Invariants. By Prof. L. E. Dickson. Pp. x+100.

(New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5s. 6d. net.

Outlines of Organic Chemistry. By Prof. F. J. Moore. Second edition. Pp. xi+325. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6s. 6d. net.

Pattern-Making. By F. W. Turner and D. G. Town. Pp. v+114. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 4s. 6d. net.

Above the Battlefield. By R. Rolland. Pp. 17. (Cambridge: Bowes and Bowes.) 6d. net.

Germany's War-Inspirers, Nietzsche and Treitschke. By Canon E. McClure. Pp. 44. (London: S.P.C.K.) 4d. net.

The Germ-Cell Cycle in Animals. By Dr. A. W. Hegner. Pp. x+346. (London: Macmillan and Co., Ltd.) 7s. 6d. net.

Geometry of Four Dimensions. By Prof. H. P. Manning. Pp. ix+348. (London: Macmillan and Co., Ltd.) 8s. 6d. net.

A Foundational Study in the Pedagogy of Arithmetic. By Dr. H. B. Howell. Pp. xi+328. (London: Macmillan and Co., Ltd.) 5s. 6d. net.

Department of Commerce. Technologic Papers of the Bureau of Standards. Nos. 30 to 35. Washington: Government Printing Office.)

Department of Commerce. Scientific Papers of the Bureau of Standards. Nos. 217, 219 to 222. (Washington: Government Printing Office.)

Department of Commerce. Bulletin of the Bureau of Standards. Vol. x. Nos. 2 and 3. (Washington: Government Printing Office.)

Department of Commerce. Circular of the Bureau of Standards. Nos. 16 and 44. (Washington: Government Printing Office.)

Report of the Commissioner of Education for the Year ended June 30, 1913. Vol. i. Pp. liv+931. Vol. ii. Pp. vi+700. (Washington: Government Printing Office.)

Department of Commerce. U.S. Coast and Geodetic Survey. Results of Observations made at the U.S. Coast and Geodetic Survey Magnetic Observatory at Vieques, Porto Rico, 1911 and 1912. Pp. 102. (Washington: Government Printing Office.)

Department of Commerce. U.S. Coast and Geodetic Survey. Terrestrial Magnetism. Results of Magnetic Observations made by the U.S. Coast and Geodetic Survey in 1913. Pp. 52. (Washington: Government Printing Office.)

State of Connecticut. Public Document. No. 24. Thirty-seventh Annual Report of the Connecticut Agricultural Experiment Station. Being the Annual Report for the Year ending October 31, 1913. Pp. xviii+441. (Hartford, Conn.)

Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. lxvi. Part 2. Pp. 227–555. (Philadelphia.)

Connecticut Geological and Natural History Survey. Vol. iv. Bulletins 16 to 21, 1910–13. (Hartford, Conn.: State Geological and Natural History Survey.)

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 3.

ROYAL SOCIETY, at 4.30.—The Thermophone: A New Form of Telephone: M. de Lange.—Hermann's Phenomenon: G. S. Walpole.

CHILD STUDY SOCIETY, at 7.30.—Self Expression through Language with Older Children: Margaret Corner.

LINNEAN SOCIETY, at 8.—An Ecological Journey in South America, Illustrated by Lantern Slides: R. C. McLean.—*Isoëtes japonica*, A. Br.: C. West and H. Takeda.

FRIDAY, DECEMBER 4.

GEOLOGISTS' ASSOCIATION, at 8.—The Fossil Flora of the Pettycur Limestone: Dr. W. T. Gordon.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Thomas Hawksley Lecture: Pumping and other Machinery for Waterworks and Drainage: (by the late Mr. W. B. Bryan) read by B. W. Bryan.

MONDAY, DECEMBER 7.

SOCIETY OF ENGINEERS, at 7.30.—Mechanical Appliances for the Painless Killing of Animals: S. M. Dodington.

SOCIETY OF CHEMICAL INDUSTRY, at 8.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Types of Political Frontiers in Europe: Prof. L. W. Lyde.

ROYAL SOCIETY OF ARTS, at 8.—The History and Practice of the Art of Printing: R. A. Peddie.

WEDNESDAY, DECEMBER 9.

ROYAL SOCIETY OF ARTS, at 8.—Domestic Metal Work of the 18th Century: W. A. Young.

THURSDAY, DECEMBER 10.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Electrical Conductivity of Echinoderm Eggs, and its Bearing on the Problems of Fertilisation and Artificial Parthenogenesis: J. Gray.—The Endemic Flora of Ceylon with Reference to Geographical Distribution and Evolution in General: Dr. J. C. Willis.

MATHEMATICAL SOCIETY, at 5.30.—Simultaneous Equations, Linear or Functional: E. H. Neville.—Integrals and Derivatives, with respect to a Function: W. H. Young.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Automatic Protective Switchgear for Alternating Current Systems: E. B. Wedmore.

FRIDAY, DECEMBER 11.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—The Geographical Distribution of *Purpura lapillus* (L.): Rev. A. H. Cooke.—The Non-Marine Mollusca of a Post-Pliocene Deposit at Apethorpe, Northants: A. S. Kennard and B. B. Woodward.—Monstrosities of Cypræa: L. St. G. Byne.—Monstrosities in *Littorina rudis*: J. E. Cooper.

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